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Nineteenth Year

Railway Age
AND RAILWAY REVIEW

Railway Engineering and Maintenance Railway Signaling

Chicago—WEDNESDAY, MARCH 7, 1928

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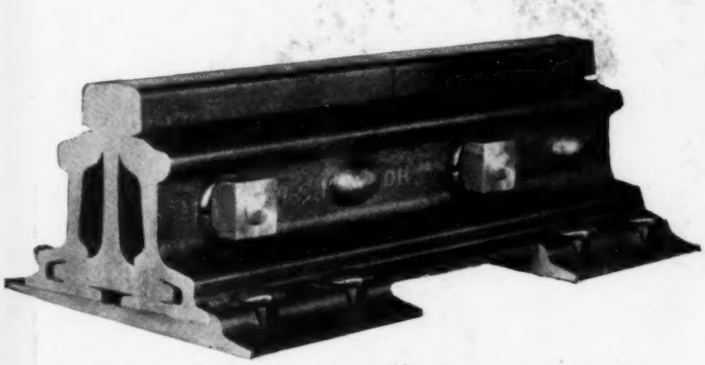

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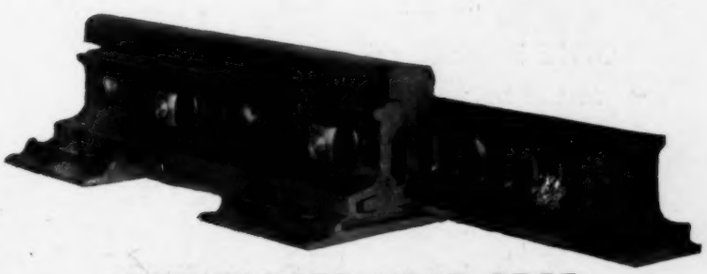

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Railway Age
Railway Engineering and Maintenance Railway Signaling
DAILY EDITION

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Make the Most of the Banquet

IF fowl is served at the annual banquet tonight, let no one lightly discard the time-honored "wishbone" or make light of its significance unless his pay check depends entirely on chasing the elusive transverse fissure. During today's sessions the Committee on Rail is expected to make a progress report on the machine which is being developed under its jurisdiction for locating and indicating the size of each transverse fissure in the track, and since this report, from all present indications, will not be final, the good wishes of every member of the association should be extended to the committee for the successful consummation of its device and for the continued success of the tests being made, which have thus far been very gratifying. If anyone should be so fortunate as to have two opportunities to express a wish with some such positive assurance of successful fulfillment as being on the long end of a wishbone, by all means let his second wish be the speedy discovery of the cause of the transverse fissure and of the means of its eradication.

Specifications for Train Control

SINCE the first train control order was issued by the Interstate Commerce Commission in June, 1922, the subject of train control has been of first importance in the signaling field, and in view of the hearings now being held before the commission it is evident that it will continue to be in the limelight. The Signal Section, A.R.A., as an official association, has functioned as a guiding agency in outlining general policies with reference to train control development, Committee X—Signaling Practice having the rather general assignment, "Automatic Train Control." Reports of this committee, under this assignment, which have been presented during the last four years, include historical data on train control, summaries and discussions of the I.C.C. orders, reports of the inspections made by the commission and analyses of accidents. In March, 1925, a discussion was presented on the extent to which wayside signals may be omitted in train control territory. Included in this committee's report yesterday was discussion of cab signaling which is evidently one of the benefits which has come from train control development. All of this information and discussion is of value. Owing to the rapid developments and changes in principles of operation and in designs, it has not been practicable for the association, up to this time, to prepare any specifications for train control equipment that would be of any value. Furthermore, the railways and the manufacturers have been busy trying to interpret and comply with the orders of the commission. However, now that train control has become an established facility certain features are accepted practice and C. H. Tillet, chairman of the Signal Section, A. R. A., in his address before the convention Monday morning, suggested that the association should now take an active

part in the standardization of train control appliances. Committee VII—A-C. Signaling, has taken a step in this direction presenting an outline on a-c. circuits and apparatus as applied to train control. It is hoped that the committee will continue its work and produce a specification that will be of benefit to roads attempting to standardize on such equipment and construction. Although important, this subject is only one of several which include equipment that can be standardized. The Signal Section may well look forward to a definite program for train control specifications.

The New Lumber Standards

IT is apparent from the report of the Committee on Wooden Bridges and Trestles that it has before it the same task that has been imposed on the Committee on Ties, with respect to the standard specifications for ties. The A. R. E. A. has collaborated in lumber standardization in the soft wood industry and has adopted the standards which were evolved for the purpose of simplifying grading rules and classifications. These standards may need some minor revision, but, as indicated by the committee, there is no reason for anticipating any important changes in the near future; in fact, if changes are to be made it will be only as need for them is developed through practical application. That there has been good reason for simplification in lumber trade practices is generally recognized. That the auspices under which such simplification has been carried out have given opportunity for a hearing of all interests concerned is also thoroughly appreciated. This being the case, it behooves those who sell and those who buy lumber to adopt the new standards, for in no other way can they realize the benefits of the improved practices. However, as indicated in the committee's report, some lumber is still being offered to the roads on the old rules, but as is the case in the marketing of ties, prices quoted on the basis of other than standard rules possess advantages that are more imaginary than real. Moreover, the fact that there are those who cannot be convinced of this tends to obstruct progress in the acceptance of any rule for common practice. It is to be hoped that the committee will be successful in its efforts to secure general acceptance of the new lumber rules by the railroads.

More Publicity for the Engineering Association

ENGINEERS in railway service in common with those in other branches of the engineering profession have long complained that they have not received the recognition that their work entitles them to. At the same time they have shunned publicity and deprecated means of directing attention to themselves. The A. R. E. A. has reflected both of these attitudes. There has long been a feeling that the work of the association was not adequately appreciated. At the same time the feeling has prevailed that in so far as publicity was concerned the work of the association should speak for itself.

The railways themselves held to a similar view a generation ago and it was only after they had been subjected to widespread and unwarranted criticism that they organized to tell the public the story of the service they are rendering. The result is a greatly changed and generally favorable public sentiment. Patterning after this experience of the railways, individually and collectively, various divisions of the American Railway Association have organized to give publicity to the work they are doing. Recognizing that the direction of publicity is as highly specialized a task as that of the technical departments of railroading itself, they have summoned experienced publicity agencies to their aid. Outstanding in the results secured was the last convention of the Mechanical division, A. R. A., which, although held in Montreal, was reported at length in the daily press throughout the United States and Canada, the total space aggregating hundreds of columns. Scarcely less successful in this direction were the efforts to acquaint the public with the meeting of the Purchases and Stores division, A. R. A., in Chicago last June. The A. R. E. A., through the initiative of President Brumley, has acceded to this tendency this year, with the result that the daily press throughout the country is being informed of the activities of this convention and through them, the public at large. This is a day of organized publicity and the A. R. E. A. has as much to gain as other organizations from a favorable opinion of the general public. The association is to be commended for the innovation that is being introduced this year.

The Signal Section Broadens Vision of Its Members

THE field of railway signaling has been practically revolutionized in the last six years. Previously interlocking plants were installed at railway crossings or junctions as a safety measure. Likewise early automatic signals were considered primarily as a means of reducing accidents. The idea that interlockings or automatic signals can expedite train movements and increase track capacity to the extent of producing handsome returns on the investment, has been given widespread consideration only within the last five or six years. The Economics Committee of the Signal Section, A.R.A., had a difficult task to get the members of its own association far enough away from the details of engineering to consider the economic aspect of signaling. However, the majority of the signal officers are now making economic studies on their own railroads.

The installation of remote power switches at outlying junction points, the consolidation of the control of interlockings and new methods of controlling signals have all been accomplished for the purpose of expediting train movements and reducing operating expenses. In planning such installations, signal engineers have learned a great deal about operating problems from the transportation officers with whom they have co-operated. With the coming of car retarders the signal engineers have again been called in on new problems of yard design and operation. When the still bigger problems of train control were presented, the signal engineers co-operated with mechanical, engineering and operating officers.

As a result of all these developments signal officers are today broader railway men than ever before. A perusal of the proceedings of the Signal Section for the last six years affords evidence that the officers of this association have so directed the work of the committees that the information presented and the discussion offered, have been of much help through this transition period. Looking into the future one can see the direction of trains by signal indication rather than by train orders. Such equipment is now operating successfully on a

limited mileage. The extensive use of such dispatching systems, together with many other developments in which the signal engineers must lend a hand, will further broaden the field of usefulness of the Signal Section. No one can rest on the oars now.

The Broadening Interest

THE increasing tendency of the American Railway Engineering Association to give constructive study to engineering-economic problems as distinguished from purely engineering problems is illustrated by instructions given year by year to some of its committees and by the work of these committees. For example, economies in operation through increasing train loads may be secured either by reducing grades or installing locomotives of greater tractive power. The association's committee on Economics of Railway Operation is not directed merely to study the reduction of grades, but, in effect, to determine the conditions under which the best results will be secured by this method of installing more powerful locomotives. This means a comparative study of the results that may be obtained by better civil engineering, on the one hand, and better mechanical engineering, on the other hand. It illustrates a very healthy tendency of engineering officers to take a broad view of railway economics, and not to think and study along merely engineering lines.

Conditions in the railroad world are always changing. Formerly—and this was especially true in the quarter century from 1895 to 1920—the overshadowing problem was that of providing for handling more traffic—of extending the lines to develop new territories and of expanding existing facilities to enable them to handle the growing business. The rapid increase of freight business and restrictive government regulation prevented railroad expansion from being adequate, although managers and engineers devoted the most intense study and efforts to making it so.

Owing to various conditions the increase in the capacity of the railways since 1920 has been relatively greater than the increased demands of traffic. Nevertheless, the need for large capital expenditures is as pressing as ever. While formerly needed principally to increase railway capacity, they are now needed principally to effect economies in operation. When the demands of increased traffic were so great that every increase in capacity would result in an increase in the traffic handled, every increase in capacity was likely to result in a more than corresponding increase in net earnings. When capacity is more than adequate, and at the same time net operating income is too low, there is obvious need for devoting relatively less capital expenditure to increasing capacity and relatively more to improvements which will save labor, fuel and materials. The more the cost of labor per hour increases the more essential it becomes to discover and adopt improvements which will reduce the amount of labor required.

What kinds of improvements will increase fixed charges the least in proportion to the operating economies through savings in labor, fuel and materials that they will make practical? For the answer the railways must rely not merely upon the engineer who can design and carry out well a piece of improvement work after it has been decided upon, but upon men who have a broad understanding of both engineering and economic problems. If operation is to be made as efficient and economical as practicable, engineers must provide the operating officer with facilities susceptible of such operation.

Announcements

The A. R. E. A. Program

TODAY—9 A. M.

Reports of Special and Standing Committees:
- **Electricity.**
- **Signals and Interlocking.**
- **Yards and Terminals.**
- **Economics of Railway Operation.**
- **Economics of Railway Location.**
- **Economics of Railway Labor.**
- **Track.**
- **Rail.**
- **Annual dinner, 6:30 p. m.**

TOMORROW

- **Roadway.**
- **Masonry.**
- **Grade Crossings.**
- **Stresses in Railroad Track.**
- **Wood Preservation.**
- **Records and Accounts.**
- **Buildings.**
- **Co-operative Relations with Universities.**

New Business.
Installation of Officers.
Adjournment.

* * *

President Brumley anounces that today's session will start at 9 o'clock and, when he said it, there was a light in his eye that showed he didn't mean maybe.

* * *

The members of the Executive Committee of the American Wood-Preservers' Association will meet in Room 2 on the third floor of the Palmer House at 10 a. m. this morning. Following the conclusion of the day's meeting the members will attend the dinner in a group.

Get Your Dinner Tickets

The Committee on Arrangements requests that those who have not yet exchanged their receipts for the tickets for tonight's banquet should do so as early today as possible. These tickets can be exchanged at the desk on the west side of the foyer. The speakers at the dinner will include L. A. Downs, president of the Illinois Central, who will talk on "The Place of the Railway Engineer;" John A. Rowland, member of the Toonto bar, who has selected as his subject "Beyond the Rail Head;" and Herbert Leon Cope, lecturer, who will talk on "Smilin' Through."

* * *

A number of A. R. E. A. committees have arranged to hold meetings in the Palmer House during the convention, among which are the following:

Today—Committee on Track, Room 5, 10 a. m.
Today—Committee on Rail Stresses, Room 4, 10 a. m.
Today—Committee on Water Service, Room 7, 12:30 p. m. Luncheon meeting with representatives of North Western Railways of India and Japanese Government Railways.
Today—General Committee, Division IV, A. R. A., Room 6, 12:30 p. m.
Today—Electrical Section, A. R. A., Room 6, 2 p. m.
Thursday—Board of Direction, A. R. E. A., Room 3, 4:30 p. m.
Thursday—Conference of chairmen of all committees with committees on Outline of Work and Personnel, Room 10, 5:30 p. m.

CONVENTIONALITIES

The new chairman of the Signal Section feels that he is justifying his name at last. Stoltz, as some of you may know, means proud, and everybody will agree that Mr. Stoltz now has reason to be proud.

* * *

In view of the repeated and embarassing mistake of the reverend gentleman who spoke at the banquet last year, it may be in order to suggest that the Committee on Arrangements post a huge sign on the speakers' table, reading: "Hey, you, these guys are engineers, not engine drivers!"

* * *

The prize, if any, for the member who has traveled the longest distance to attend the convention should undoubtedly go to J. A. Vardon, executive engineer, Northwestern Ry., Lahore, Punjab, India.

* * *

Chief Engineer—"What sort of vine shall I bring you, dear?"

His Wife—"Why don't you bring me some of that rail anti-creeper?"

* * *

We are glad to be able to announce officially that the United States Steel Corporation quartet will not sing at the banquet this year. For those who do not know, said quartet consists of F. R. Layng of the Bessemer & Lake Erie, first tenor, E. H. Dresser of the Duluth, Missabe & Northern, second tenor, W. A. Clark of the Duluth & Iron Range, baritone and A. Montzheimer of the Elgin, Joliet & Eastern, basso profundo.

* * *

While the American Society of Civil Engineers has always followed the proceedings of the A. R. E. A. with interest, Hunter McDonald remains the only man who has been president of both organizations. The present president of the A. S. C. E., however, Lincoln Bush, was active in the A. R. E. A., as chief engineer of the Delaware, Lackawanna & Western, before he left railway service, and still retains his membership.

* * *

It is interesting to speculate on the power of initials. For instance, if C. E. Johnston, C. E., and C. E. Smith, C. E., had been christened X. Y. Johnston or P. Q. Smith, or some other initials less harmonious to the profession they were to follow, would they both have reached executive positions and both in the same year? As may be recalled, Mr. Johnston was recently elected president of the Kansas City Southern and Mr. Smith vice-president of the New York, New Haven & Hartford.

* * *

As vice-president of the Illinois Central, Fred L. Thompson naturally carries a flock of passes, but, the pass of which he is most proud is a gold pass, good forever, entitling him to free admission to all athletic activities at the University of Illinois. Only three of these passes were presented, one to each of the engineers who donated their services in designing the new stadium at Champaign.

* * *

Among the construction contracts awarded yesterday were two for work on the New York Central in New York. Henry Dubois Sons Company, New York, were awarded a contract for dredging in the Hudson, Harlem and East rivers in the vicinity of New York Central water-side structures. New overhead roadways along the west side of the Grand Central terminal and the Terminal office building and over the Forty-fifth street viaduct will be constructed by James Stewart & Co., New York. This contract also involves slight alterations in the station and office building.

* * *

The Orient is quite largely represented at the convention this year. There are eight Japanese members and guests in attendance. These include Y. Kamimura, engineer maintenance of way, Tokio; T. Matsumara, civil engineer, Tokio; K. Tai, chief engineer, Sendai division, Sendai; Dr. M. Suzuki, engineer, Tokio, and K. Sone, mechanical engineer, Tokio, all of the Imperial Japanese Government Railways. The South Manchurian Ry. is represented by S. Nishikawa, civil engineer, Y. Abe, signal engineer, and M. Hoshihara, metallurgist of the railway's subsidiary, the Anzan Steel Works, all with headquarters at Dairen, Manchuria. The Formosan Railway is represented by B. Horiguchi, civil engineer.

* * *

The members of the association's committee on flood control are to be distinguished from the other delegates by the wild light shining in their eyes. One can hardly blame them, for what railway man could help being wild at the thought of the government making the railways foot the bill for more than $75,000,000 of construction work in connection with the Jadwin plan, without recompense. The association's committee, which has only recently returned from Washington after presenting the railways' case before the Committee on Flood Control of Congress, consists of the following:

A. F. Blaess, chairman, chief engineer, I. C.
Hadley Baldwin, chief engineer, C. C. C. & St. L.
R. W. Barnes, chief engineer, S. P.
E. A. Hadley, chief engineer, M. P.
W. L. Hanley, chief engineer, St. L. S. W.
F. G. Jonah, assistant to president and chief engineer, St. L.-S. F.
C. S. Kirkpatrick, chief engineer, G. C. L.
C. R. Mee, chief engineer, L. R. & N.
E. F. Mitchell, chief engineer, T. & P.
C. A. Morse, chief engineer, C. R. I. & P.
E. F. Salisbury, chief engineer, L. & A.
C. R. Knowles, secretary, chief of water service, I. C.

Here's the Water Service Committee—This Meeting, Which Was Held in Chicago, October 4, is Claimed by Clarence Knowles, the Chairman, to Be the Best Attended Committee Meeting Ever Held. The Total Attendance Was 30, and They Came from Nearly Everywhere

The A. R. E. A. Met in the Grand Ball Room Yesterday

Attendance at A. R. E. A. Convention Establishes New Record

Large hall affords adequate space for meeting —Nine reports presented during day

ALTHOUGH the Grand Ball Room of the Palmer House, Chicago, is by far the largest room ever used by the American Railway Engineering Association for convention purposes, it was well filled when President D. J. Brumley (chief engineer, Chicago Terminal Improvements, Illinois Central) called the meeting to order promptly at 9:30 yesterday morning, the attendance at the meeting exceeding all previous records for the first day.

Shortly after calling the convention to order, Mr. Brumley reviewed the work of the association during the last year, referring to the more important developments and outlining the progress made. After receiving the reports of the secretary and treasurer the convention then proceeded to the consideration of the reports of the standing and special committees on Standardization; Uniform General Contract Forms; Water Service; Ties; Ballast; Iron and Steel Structures; Wooden Bridges and Trestles; Shops and Locomotive Terminals; and Rules and Organization. A session was also held in the evening, at which moving pictures were presented, showing The Baltimore and Ohio Railroad Fair of the Iron Horse and The Mississippi Valley Flood of 1927.

President Brumley's Address

The year's effort of the working committees is expressed in the bulletins you have had in your possession for some weeks. The committees which were organized immediately upon the adjournment of the last annual meeting have worked with a fixed date as controlling in point of time and so organized themselves that the expectations of the board of direction could be realized. The working committees for the ensuing year have been organized and their work has been assigned, subject to such modifications as may be found necessary after the adjournment of this convention. Some of the reorganized committees have held meetings in December and others in January and February. By this new method, we have gained nearly three months on the new year's work. This will materially increase the working period, thereby giving more time for the consideration of reports and insure their completion this year before November 30. This is done for the express purpose of getting the reports in your hands at least two months in advance of the annual convention, thereby insuring you time enough to review them carefully and to prepare for constructive discussion when the reports are formally presented next March.

Transverse Fissures in Steel Rail

Among the major subjects under investigation by the working committees is the development of a device for the detection of transverse fissures in steel rails. Detection of such rails by visual inspection was laborious, slow and uncertain unless the radial growth from the nucleus had extended to the contour of the rail section. The magnetic testing device originated by the Bureau of Standards, after exhaustive tests by two railroad companies and a steel company, was abandoned. The Rail committee has been working for two years with the Sperry Development Company to perfect a device which employs the principle of air gap resistance to the flow of electrical current to disclose the location and extent of transverse fissures. The laboratory tests

having demonstrated the feasibility and practical working of the device, authority was obtained from the American Railway Association to expend $23,306 on the development and building of a transverse fissure detector car. That unit is built and is now on the lines of the New York Central, undergoing preliminary tests and adjustment before final acceptance by the Rail committee. A schedule for the lease of the car, at a stipulated daily rental, to a number of railroads, has been prepared by the Rail committee, the idea being to demonstrate the use of the device in widely separated sections of the country. However, to make an inspection of all the rails in the main tracks on the North American continent will require the use of many machines, the number depending upon the frequency with which such inspections are made.

Rayhuff-Richter

Daniel J. Brumley
President

Mr. Brumley is representative of the long line of engineers who have received recognition for their work in the interest of the association and of their standing in the railway industry by being accorded to the highest honor which the A. R. E. A. can bestow on any of its members. Following a varied experience in railway construction and maintenance over a period of 19 years, he was selected to organize the valuation work on the Illinois Central. Six years later, in 1920, he was appointed chief engineer of the Chicago Terminal Improvements, a position he occupies at the present time. Mr. Brumley does not take responsibilities lightly. He accepted the presidency of the A. R. E. A. with a full realization of the demands which it would make on his time. As a consequence he has had an exceedingly busy year and the record shows that it has been a year of progress.

Federal Valuation

It is of interest to note that the federal valuation work, begun in 1913, is approaching the competion of its primary phase. Tentative valuations have been served on all carriers subject to provisions of the Valuation act. Hearings are concluded on 70 per cent of the protests and if the present rate is maintained all of the cases should be before the Interstate Commerce Commission early next year. It is proposed to bring the valuation to date and recommendations to accomplish this are before Congress. It is assumed that this work can be completed by 1931, at a cost of $7,500,000 to the government, after which time the cost of maintaining a current valuation would be $500,000 annually.

Valuation work to those carriers subject to recapture under the provisions of the Transportation Act of 1920, has developed into a problem of first importance as the total payments made by the carriers on account of recapture to the end of last year, amounted to approximately $8,000,000. The administration of Valuation Order No. 3, covering the accounting for additions, betterments and retirements, valuations to be established in recapture cases, and the accounting regulations under provisions of the proposed Depreciation Order 15100, all have an intimate and a vital bearing on engineering estimates, analyses and economic studies. The railway engineering problems that now confront you include not only the fundamentals of pure engineering principles of a generation ago but deal also with accounting, valuation, law and related subjects.

Centenary Exhibition

The year 1927 marked the completion of the first century of rail transportation in the United States. On February 28, 1827, the State of Maryland issued a charter for building a railroad from the City of Baltimore to the western terminus on the Ohio river. History records that the first construction mark of this new enterprise was started July 24, 1828, and the completed track reached the east bank of the Ohio river January 1, 1853.

To those pioneers who were compelled to originate and develop engineering practice, standards for roadbed, track structure, buildings, bridges, equipment, and construction methods, the time spent in this first construction must have seemed long but to those who review it now in the light of all the facts, it was a most remarkable performance. The work of these pioneer engineers was well done.

Floods of 1927

Two sections of the United States were visited by the most disastrous floods known—one which embraced the valley of the Mississippi river and its tributaries, and the other the States of New York, Vermont, New Hampshire, Connecticut and Massachusetts. The floods of the Mississippi river are recurring events. During the year 1927 the gage reading at all Government stations, except New Orleans on the main stream, showed greater heights than ever before observed. The flooded area, about 18,000 square miles, rendered inoperative approximately three thousand mles of railway for period ranging from 10 to 120 days. The direct property loss to the railways was

$20,000,000. It is estimated that 600,000 people were driven from their homes and the total property damage in the submerged area exceeded $300,000,000.

The authorities of the states on the lower course of the stream and federal commissions, have co-operated for many years in designing and building levees and other protective works to confine the waters to a defined channel. Further protective measures are now under consideration by government engineers whose reports are before Congress. Your board of direction at a meeting last June, authorized the creation of a special committee on the Mississippi river flood for the purpose of collecting information available to the railways and present it to the association membership and the proper committee of Congress. On account of the urgency of getting the data, although incomplete, before Congress, the earliest information was published in Bulletin 297 issued last July. This proved of so much value to the House committee, the information was revised to a later date and published as Bulletin 303, Part 2, January this year. This disaster created a real opportunity for your association to compile and place the facts of the flood, respecting the railways in the Mississippi Valley, before Congress. Much credit is due the able chairman and members of the special committee for the great amount of effort and time required to compile the data and complete the report.

Future Work

A review of the work done by your association in the past 29 years invites some speculation as to its work for the succeeding generation of engineers. It is clear that the need for new rail lines and extensions is almost satisfied and it would appear that the work for the immediate future would be the orderly development of rail lines in existence. Electrification no doubt will be extended since it has great operating advantages over steam under given conditions, such as density of traffic, heavy grades, feasibility of operation in congested terminals, a commutation service where frequent stops are made and operation under covered areas where air tight developments are justified. The steam locomotive, or some other form of self-contained unit, for many purposes has operating advantages, and the immediate future, at least, has many possibilities for its improvement and the development of internal combustion and storage battery locomotives.

The railway terminal problem in a great city is one requiring long experience in railway engineering, resourcefulness of design, a broad conception of civic requirements, and great patience in dealing with legislative and regulatory bodies whose representatives are not familiar with the necessities of railway transportation. Members of this association have done some of this work in the past but much of the work in the future will deal with problems more concerned with economic phases and betterment of existing lines rather than the construction of railroads into unoccupied territory.

Proposed Change in Convention Procedure

At the last meeting of the association, under new business, the following motion, made by L. A. Downs, was adopted:

"The opening day of our meeting the Committee on Records and Accounts came forward with a new plan of procedure for the association. I believe any member of this association has a perfect right at any time, in an orderly way, to make suggestions for the betterment of the association, and I think that any group of men, as was done in this case, even though they were out of order in doing so, should be given some consideration. I therefore wish to make a motion that the board of direction give consideration to the suggestions that this committee made."

The board of direction through a committee appointed for this express purpose, has made a study of the points on convention procedure questioned by the Committee on Records and Accounts. This board committee, through contact with the working committees and by replies to a questionnaire addressed to the entire membership, has obtained a representative cross section of your views. The alleged deficiencies may be classified as:

	Per cent	Per cent
1. Sectional meetings	Yes— 6.25	No—93.75
2. Lack of discussion	" 60.00	" 40.00
3. Elimination or curtailment of progress reports	" 29.50	" 70.50
4. Four-day versus three-day convention period	" 23.77	" 76.23

Since the board committee's report will be distributed during the morning session of the third day of this meeting, I will briefly summarize the general trend of the replies to the questionnaire:

1. Sectional Meetings.

The association has only one purpose "the advancement of knowledge pertaining to the scientific and economic location, construction, operation and maintenance of railways.

Would tend to split up association.

Many members attend the convention to meet others engaged in railway work, listening to or participating in discussions on all subjects.

Committee meetings are virtually sectional meetings where there is no restriction on discussion.

No procedure is good that will prevent everyone from hearing reports on all subjects, and would reduce the educational value of the Association.

The American Railway Engineering Association represents one branch of railway service—railway engineering. It differs from the A. S. C. E. and the A. S. T. M. and the same reason does not apply for further subdivisions. In fact, it is a distinct reason for not carrying out the sectional meeting plan.

2. Lack of Discussion.

Caused by late committee reports. This defect was corrected this year. The last bulletin was mailed you on February 7. The reports submitted in the early years of the association contained subjects which were familiar to nearly all the members present. These elementary subjects settled, the association next dealt with questions relating to specialized and technical subjects.

Members not specializing on certain subjects will not criticise reports.

Discussion needed if committees have gone astray.

We now have better and more scientific discussion than other engineering organizations.

Can be remedied by preparation in advance to discuss reports.

Good reports warrant little discussion: immature reports will cause discussion.

Differences are adjusted by committees while report is in course of preparation.

Written discussion prepared by members will eliminate aimless and irrelevant discussion.

3. Elimination or Curtailment of Progress Reports.

Amount of detail depends on progress committee has made.

Details are necessary to grasp the full value of included material.

Many committees work by progress reports which are as important as the final report.

Need not be in detail but salient features should be pointed out to draw out members' views and develop suggestions.

Curtailment would withhold valuable information from interested members and would not help the situation, it would detract from interest of members on committees, and would result in indifferent committee work.

Present practice is satisfactory.

4. Three-day Versus Four-day Sessions.

Cannot hold interest of members more than three days.

By proper organization and preparation of members, the business can be transacted in three days.

Four-day sessions would not increase interest but would increase the number leaving before the end of the convention.

Four days too long—three enough.

If time is too short, hold an evening session.
Not required now—will work out when extra day is needed.

The Committee on Records and Accounts also suggested that the work of evolving a new and comprehensive manual be undertaken by a staff of paid full time experts at association headquarters. The manual results from investigations, studies, reports and conclusions of the working committees composed of experts along their particular lines. To become effective their conclusions must be approved by the association. To carry out the suggestion of Committee on Records and Accounts is contrary to the principles on which this association has successfully operated for 29 years under the present method. The suggested Manual committee could not perform any greater service for the association than is now done by each of the working committees and the secretary.

To my personal knowledge the issues suggested by the resolution referred to have been continuously before your board of direction for at least six years. Your board has insisted (and your response was always whole-hearted) that subjects should be fully developed, well thought-out and matured before being presented for adoption as recommended practice. Reports prepared under such limitations have resulted in apparent lack of constructive discussion at the time of presentation for adoption. However, some consideration should be given to the exhaustive discussions had by the committee when a report is being prepared. The committees have been enlarged from year to year to make them more representative of the differing conditions obtaining on many railways and thereby insure more complete and comprehensive reports. These methods have largely contributed to less constructive discussion at the annual meetings. It would seem that this condition is not a serious shortcoming but rather a helpful indication that the association is making real progress along logical lines. The earlier publication of committee reports, the reorganization of the committees and assignment of work on December 1 each year, and the continuance of committee work during the winter season will in a large measure remedy the faults complained of as to this phase of convention procedure.

It is to be noted that your views as expressed by the replies to the questionnaire are not to go to the sectional meeting plan, neither to eliminate nor curtail progress reports, nor adopt the four-day convention plan. After an exhaustive study of the material you supplied for the determination of these most involved problems, your board of direction has reached the conclusion that no changes, other than the corrective measures already taken, are necessary at this time.

Report of Secretary E. H. Fritch

At the time of the formation of the Association, the field to be covered—the engineering department of the railways—was divided into 14 sub-divisions, and a committee appointed for each division. The developments in railway service in subsequent years made it necessary and desirable to enlarge the scope of the Association, and to create additional committees to meet the newer problems and even to anticipate requirements. At the present time there are 23 standing and three special committees considering roadway and track problems, and electrical problems, railway economics and a number of miscellaneous problems. In all, the various committees include a total of 715 members of the Association.

Membership

The additions, changes and losses in the membership rolls during the year are indicated in the following table.

Membership as of March 1, 1927		2,511
Additions during the year	173	
Losses by death	29	
Resignations	30	
Dropped from rolls	18	77
Net gain		96
Total membership as of March 1, 1928		2,607

The following table is a departmental classification of the membership:

General officers	165
Conducting transportation	103
Maintenance of way and structures	1785
Maintenance of equipment	22
Traffic officers	5
Accounting officers	11
Purchasing and stores department	3
Professors in colleges	63
Miscellaneous	450
Total	2607

Deceased Members

Twenty-nine members of the Association passed away during the year, including four charter members, a past-president and

E. H. Fritch

two past-treasurers. Following is a list of the deceased members:

C. I. Anderson, assistant engineer of buildings, I. C.
Willard Beahan, first assistant engineer (retired), N. Y. C.
W. P. Bruce, vice-president and general manager, N. C. & St. L.
George H. Bremner, formerly district engineer, C. B. & Q.; district engineer, Bureau of Valuation Interstate Commerce Commission; treasurer of the Association from 1911 to 1927.
William H. Burrage, division engineer, N. Y. C. & St. L.
William S. Dawley, charter member, first treasurer; formerly chief engineer, C. & E. I.; also Chief Engineer, Yunnan-Szechuan-Tengyueh Railway of China; Consulting Engineer.
George Eisenhauer, electrical engineer, Erie.
William L. Ekin, chief engineer maintenance of way, western region, Penna.
Edwin O. Faulkner, manager tie and timber department, A. T. & S. F.
Charles F. W. Felt, charter member; president, 1926; chief engineer, A. T. & S. F.
A. S. Going, terminal engineer, C. N. R.
Charles B. Hoyt, charter member; retired superintendent of track, N. Y. C. & St. L.
William H. Hoyt, chief engineer, D. M. & N.
C. W. Huntington, formerly president, Virginian.
T. J. Irving, division engineer, C. & N. W.
John D. Keiley, division engineer, C. & O.
W. P. Kimble, assistant engineer, Erie.
Paul Kircher, vice-president, Canada Concrete Products Company.
George A. Mountain, charter member; chief engineer, Canadian Railway Commission.
F. P. Patenall, signal engineer, B. & O.
Kenneth G. Polyblank, assistant chief engineer, Rouyn Mines Railway Company, a subsidiary of the Canadian National.

A. C. Prime, consulting engineer, Philadelphia, Pa.
C. J. Scribner, engineer of scales, C. B. & Q.
H. T. Spengler, professor of railway engineering, Lafayette College.
Arthur C. Smith, vice-president, Morden Frog and Crossing Works.
George W. Snyder, II, assistant chief engineer, Penna.
Charles Yoder, engineer maintenance of way, N. Y. C.
S. Davies Warfield, president, S. A. L.
H. K. Wicksteed, locating engineer, C. N. R.

Publications

Through the effective co-operation of the various committee chairmen, it has been made possible to issue the reports in the bulletins during the past year far enough in advance of the annual meeting to give ample time for their study and the preparation of discussion.

The proceedings of the A. R. E. A. are properly conceded to be an encyclopedia of practical information of great value to the busy executive and to the railway officer in need of data on problems confronting him in his daily routine. Volume 28, proceedings for 1927, is a noteworthy contribution to the literature on the science of railway engineering.

The issuance of the revised Manual is under way and the new Manual will be published as soon as practicable after the annual convention. Approximately one-third of the material is in type, and satisfactory progress is being made on the remainder. Progress is also being made in the compilation of the general index, which it is expected, will be published.

In addition to the regular reports of the committees, eight valuable contributions were made by members to the work of the Association, on the following subjects:

The Mississippi Valley Flood—1927; Freight Train Curve-Resistance on a One-Degree and a Three-Degree Curve; The Highway Grade Crossing Problem; Boiler Feed Water Studies; Sink-Head Ingots; Traffic Capacity of a Railway; A Simplified Formula of the Secant Type; and The Purchase of Materials, Tools, Appliances and Supplies.

FINANCES

The following is a summary of receipts and disbursements during the calendar year ending December 31, 1927:

Balance on hand January 1, 1927		$53,743.20
Receipts during 1927	$53,663.51	
Paid out on audited vouchers	53,401.26	
Excess of Receipts over Disbursements		262.25
Balance on hand December 31, 1927		$54,005.45

Miscellaneous

During the year there were a number of changes in the Board of Direction. The death of George H. Bremner on April 2, 1927, caused a vacancy in the office of Treasurer, which was filled by the appointment of F. J. Stimson, assistant chief engineer maintenance, Pennsylvania.

J. de N. Macomb resigned as Director on account of leaving railway service, and his unexpired term was filled by W. J. Backes, chief engineer, Boston & Maine. Frank Lee also resigned as Director, on account of transfer of headquarters to the Pacific coast, and his unexpired term was filled through the appointment of J. E. Armstrong, assistant engineer, Canadian Pacific.

The device developed under the auspices of the Committee on Rail in 1927, designed to detect the type of rail failure known as a "transverse fissure," is nearing completion, and a trial test is to be made in the near future. The construction of this car has been financed by the American Railway Association.

Financial Statement for Calendar Year Ending December 31, 1927

Balance on hand January 1, 1927		$53,743.20
RECEIPTS		
Membership Account		
Entrance Fees	$ 1,850.00	
Dues	24,799.79	
Binding Proceedings and Manual	1,802.95	
Badges	16.00	
Sales of Publications		
Proceedings	2,779.90	
Bulletins	1,678.01	
Manual	494.50	
Specifications	826.76	
Leaflets	219.00	
Track Plans	409.75	
Advertising		
Publications	2,975.20	
Interest Account		
Investments	2,217.50	
Bank Balance	152.81	
Annual Meeting		
Sale of Dinner Tickets	4,980.00	
Miscellaneous	52.83	
American Railway Association		
Rail Investigations	8,408.51	
Total		$53,663.51
DISBURSEMENTS		
Salaries	$ 9,769.92	
Proceedings	5,903.82	
Bulletins	14,346.55	
Track Plans	120.00	
Stationery and Printing	2,879.38	
Rents, Light, etc.	845.00	
Supplies	502.28	
Expressage	711.34	
Postage	1,034.41	
Exchange	95.44	
Committee Expenses	170.30	
Officers' Expenses	116.40	
Annual Meeting	6,791.24	
Refund Dues, etc.	21.00	
Audit	155.00	
Miscellaneous	706.62	
American Railway Association—Rail Investigations	9,232.56	
Total		$53,401.26
Excess of Receipts over Disbusements		$ 262.25
Balance on hand December 31, 1927		$54,005.45

The birthplace of the A. R. E. A.—The Successful Career of This Association Was Launched at the Iroquois Hotel, Buffalo, N. Y., on March 30, 1899. At That Meeting the Constitution Was Presented and Adopted and the First Officers Elected and Installed

Consisting of:	
Bonds at Cost	$43,285.89
Cash in S. T. & S. Bank	10,694.56
Petty Cash Fund	25.00
	$54,005.45

STRESSES IN TRACK FUND

Balance on hand January 1, 1927	$ 1,913.40
Received from Interest during 1927	54.34
Paid out on audited vouchers during 1927	62.87
Balance on hand December 31, 1927	$ 1,904.87
Total	$ 1,967.74

Report on Uniform General Contract Forms

J. C. Irwin (B.& A.)
Chairman
C. Frank Allen (Cons.Engr.)
H. E. Barlow (C.,St.P.M.& O.)
W. H. Brameld (Erie)
B. S. Dickerson (E.I.& T.H.)
W. D. Faucette (S.A.L.)
F. H. Fechtig (A.C.L.)
B. Herman (Sou.)
J. S. Lillie (G.T.W.)
S. L. Mapes (C.R.R.of N.J.)
A. A. Miller (M.P.)
O. K. Morgan (Cons.Engr.)

J. C. Irwin

Clark Dillenbeck (Reading)
Vice-Chairman
S. Murray (O-W.R.R.& N.Co.)
F. L. Nicholson (N.S.)
C. B. Niehaus (C.of Ga.)
W. C. Nusz (I.C.)
H. A. Palmer (C.N.R.)
C. Silliman (Pres.Conf.Com.)
H. Smith (N.Y.C.& St.L.)
E. L. Taylor (N.Y.N.H.& H.)
C. A. Wilson (Cons.Engr.)
J. Worley (Hab'shaw C.& W.Co.)

THE COMMITTEE presented reports on the following subjects: (1) Revision of Manual (Appendix A); (2) Form of agreement for joint use of freight terminal facilities (Appendix B); (3) Form of agreement for use of railway property for public highways (Appendix B); (4) Form of construction contract for particular items of work (Appendix C); (5) Form of cost-plus percentage construction contract (Appendix C); and (6) Form of agreement for joint ownership, use and management of a terminal project (Appendix B).

It recommended: (1) That the changes in the Manual in Appendix A be approved and the revised version substituted for the present recommendation in the Manual. (2) That the form of agreement for the joint use of freight terminal facilities, as printed in Appendix B, be approved for publication in the Manual. (3) That the subject "Form of agreement for use of railway property for public highways" be eliminated from the outline of work, as there seems to be no general need for such standard form. (4) That the conclusions in Appendix C in regard to the method of preparing a form of construction contract for particular items of work, be followed and that this subject be eliminated from the outline of work. (5) That the form of cost-plus percentage construction contract, as printed in Appendix C, be received as information, and (6) That the subject "Form of agreement for joint ownership, use and management of a terminal project" be included in the outline of work for the ensuing year.

Appendix A—Revision of Manual

During the year, the committee gave careful consideration to the revision of two forms appearing in the Manual; a form of agreement for interlocking plant; and a form of agreement for industry tracks, and as a result recommended a considerable number of changes in each form. It reported that the recommendations for changes in the form of agreement for an interlocking plant result from joint study of the form by this subcommitte and Committee VII of the Signal Section, American Railway Association.

The recommendations for changes in the Form of agreement for industry track result from conferences of a special committee of the committee, headed by the general chairman, with representatives of the industries and with consulting counsel. Study of the liability section of the form is still in progress and this was not included in the present recommendations, but the committee hopes to make definite report on this subject at the annual meeting.

Appendix B—Joint Use of Freight Terminal Facilities

Last year the committee submitted for discussion a report on this subject, including a proposed form of agreement. This year the committee recommended for adoption, the form presented last year, with slight modifications in five different points in the form.

Appendix C—Construction Contract for Particular Items of Work and Cost-Plus Percentage Construction Contract

The committee made a careful study of the first subject and after preparing a tentative form reached the conclusion that such a form of contract would consist of a copy of certain parts of the form of construction contract. It was further determined that the form would vary for different items of work, and it would be difficult to determine how much or how little of the form of construction contract should be used in preparing such a standard form.

As a contract for particular items of work could readily be written by taking and using such parts of the construction contract as may be found necessary, the

committee recommended that this subject be discontinued and no such form prepared at this time.

The committee continued the study of the second subject, cost-plus percentage construction contract, and in its report, it submitted a form of cost-plus percentage construction contract for information and discussion.

Discussion

[Chairman J. C. Irwin (B. & A.) presented the report, and outlined the work of the committee during the year and the method of procedure adopted.]

Chairman Irwin: The work on Form of Agreement for Interlocking Plant, was assigned to Committee 7 of the Signal Section of the A. R. A. a few years ago and after some discussion was presented to the A. R. E. A. a standard form which has been in the Manual since 1918. However, it was agreed that some changes should be made in that form and this committee voted to co-operate with Committee 20 of the A. R. E. A. in preparing a new form which they could jointly recommend for adoption.

As a result, the general chairman of these committees conferred and the subjects were assigned to two subcommittees, which worked jointly and are now in agreement in recommending the standard form for the A. R. E. A. which will also be recommended by the Signal Section of the A. R. A.

The special reason for reconsidering the Form of Agreement for Industry Track was the fact that in some features it is hard to get the railroads to agree on the standards and the railroads had difficulty in getting all industries to agree. Specific objections were brought to the attention of President Aishton of the A. R. A. by a committee of the American Petroleum Institute. It was found that the A. R. E. A. form as already adopted, disposed of most of the objections raised. At the same time some sections could be changed to advantage, making it somewhat clearer to the industry and at the same time not departing from any of the principles which the railroads had already adopted.

After a series of meetings of Committee 20 in which in some cases the committee of the American Petroleum Institute sat in, some revisions of minor importance were made. After these meetings the committee felt it had gone as far as it could.

The liability section, the A. R. E. A. form adopted 1923, probably is more favorable to the railroads than any other in use. This is used by a few companies and especially the Delaware & Hudson, which has it in all its agreements. On the other hand, about the same time this association adopted this form, the Association of Railway Executives was conferring with the National Industrial Traffic League, and the wording of the liability section of the industry track agreement was one of the things considered. The result of the conference was an agreement on what is known as the "Nit" League clause. This was finally acted on by the Association of Railway Executives, and it was recommended that this liability section be used.

This committee investigated what has occurred since. A great part of the railroads in the country are already using it, and the Association of Railway Executives has not revised it. Therefore, the committee recommends the use of the so-called "Nit" League liability section in place of the liability section now in the agreement.

[Subcommittee Chairman F. L. Nicholson (N. S.) announced several corrections in the printed report and *moved the adoption of the report for inclusion in the Manual.* After explanatory discussion on the arbitration clauses contained, the *motion was adopted.* Mr. Nicholson then explained the recommendations concerning the form of industry track agreement and *moved their adoption,* saying in addition that this contract is very closely asociated with the rules of the traffic department of railway companies and it would be proper, before this is printed in the Manual, that conferences be held with the traffic committee of the American Railway Association and an agreement reached on the terms this committee has worked out.]

W. C. Bolin (B. & O. C. T.): I do not gather from the reading of the liability clause whether that fully covers the expense that the railroad might be put to in protecting a private grade crossing. It seems to me that the expense that might be incurred in a private grade crossing outside the right-of-way of the railroad company ought to be provided for.

Mr. Irwin: A standardized form possibly cannot cover some things that some companies would like to have covered, and in connection with construction and maintenance this form leaves a blank space for the parties to write in what they see fit. The tendency of this committee has been to put the industry to any expense or liability incurred on account of special service given the industry which is different from that rendered on general delivery tracks.

This question of negligence of the company's employees and the question of expense have not been finally settled, and in the liability section we have thought it best to follow the work of the Association of Railway Executives, which had a special committee appointed for the purpose of agreeing with the National Industrial Traffic League on this very thing. While we may later develop some section which will be more satisfactory, the only thing for this body to do at the present time is to take the liability section which had been approved.

[The motion to adopt the form of industry track agreement was put to a vote and carried. This was followed by the adoption of the agreement for the joint use of freight terminal facilities and *a motion was made to eliminate the form of agreement for the use of highways as recommended.*]

R. H. Ford (C. R. I. & P.): I can't agree with the committee. The present agreement presents difficulties, but there is a need for something of that character. The development of the American highways with relation to railway property is becoming more and more acute. The through highways are being relocated in such a way that they are crossing or adjoining railway property. There is a feeling on the part of highway officers, that the railways should surrender their property wherever it may not be necessary for their immediate use. The question is whether or not they are in a position at this time to forecast future needs, particularly around railway stations. It would be a great mistake for the committee to end its labors in that particular merely because it has not yet received any great response from inquiries.

E. L. Taylor (N. Y., N. H. & H.): Our committee gave very careful consideration to the preparation of this form. We prepared the best form that we could under the circumstances. When we sought a definite use for such a form we had quite definite answers and practically all of them were against publishing such a form. The reason is that in the construction of a public highway the public funds are being expended and no public board of authority could expend funds under an agreement where recapture by the railroad was possible.

Mr. Ford: This question of recapture is not a seri-

ous matter on the average American railroad. I think the duty of this committee is to comply with its instructions and to report a form. If this association doesn't want to adopt the form it should instruct the committee to do something else with it.

W. H. Kirkbride (S. P.): I agree with Mr. Ford.

[The *motion to eliminate the form was withdrawn* following which the committee presented forms of construction agreements.]

J. P. Hanley (I. C.): I should like to bring up the question of possibly extending the agreements to cover tornado insurance as well as fire insurance. I recall a case where a water tank was shattered by lightning just before it had been taken over from the contractor, and in view of the fact that the contractor did not have any insurance to cover this particular kind of hazard the company was compelled to restore the structure.

Mr. Irwin: It is a good point and we will consider it in our future work.

Mr. Baldridge: The contract form for cost-plus work provides that the contractor shall furnish all materials, etc. It also provides for payment of these materials plus percentages, etc. It seems to me that the committee should include the following miscellaneous expenses. "At the conclusion of the work, all unused materials and supplies shall become the property of the contractor who shall refund to the company all moneys paid for them plus all percentages allowed thereon." That will serve as a deterrent to the contractor who is in the habit of purchasing unnecessary materials with the expectation that the railroad will pay for them.

Mr. Irwin: I am very glad to accept this suggestion.

[The committee was excused with the thanks of the association.]

Report of the Committee on Water Service

C. R. Knowles (I.C.)
Chairman
C. M. Bardwell (M-K-T)
W. M. Barr (U.P.)
S. C. Beach (I.C.)
O. W. Carrick (Wab.)
R. W. Chorley (Penna.)
R. E. Coughlan (C.& N.W.)
J. H. Davidson (M-K-T)
B. W. DeGeer (G.N.)
L. E. Elliott (St.L-S.F.)
H. W. Faus (N.Y.C.)
J. M. Fitzgerald (C.of Ga.)
E. M. Grime (N.P.)
J. P. Hanley (I.C.)
J. R. Hickox (C.B.& Q.)
R. L. Holmes (T.& P.)
S. C. Johnson (C.& O.)
F. H. Kornfeld (L.& N.)

C. R. Knowles

R. C. Bardwell (C.& O.)
Vice-Chairman
C. H. Koyl (C.M.St.P.& P.)
P. M. LaBach (C.R.I.& P.)
E. G. Lane (B.& O.)
W. B. McCaleb (Penna.)
A. B. Pierce (Sou.)
O. T. Rees (A.T.& S.F.)
H. H. Richardson (M.P.)
R. W. Savidge (U.P.)
T. D. Sedwick (C.R.I.& P.)
H. E. Silcox (C.& O.)
D. A. Steel (Ry.Age)
R. A. Tanner (N.P.)
H.W. VanHovenberg (St.L.S.W.)
J. B. Wesley (M.P.)
A. E. Willahan (K.C.S.)
D. Wood (S.P.)
F. D. Yeaton (C.M.St.P.& P.)

THE SUBJECTS considered by the committee included the following:

(1) Revision of the Manual (Appendix A);

(2) Drinking water supply on trains and premises of railways (Appendix B);

(3) Pitting and corrosion of boiler tubes and sheets (Appendix C);

(4) Value of water treatment and comparison of methods (Appendix D);

(5) Report on various types of hydrants for coach yard and general service (Appendix E);

(6) Most suitable kinds and types of pipe for small service lines (Appendix F);

(7) Use of gravity and pressure filters (Appendix G);

(8) Methods for disposal of sludge at water softening plants (Appendix H);

(9) Design and maintenance of track pans for locomotives (Appendix I);

(10) Methods used in obtaining successful wells in fine sand formation (Appendix J); and

(11) Proper spacing of water stations in capacity of engine tenders (Appendix K).

The committee recommended that subjects 1, 3, 7, 9, and 10, Appendices A, C, G, I, and J be reassigned to it; that Appendices B and D be received as information and the subjects reassigned; and that the information in Appendices E, F, H, and K be received as information.

Appendix B—Drinking Water Conditions During Mississippi Flood

Not the least of the problems involved in connection with the Mississippi River flood was the question of drinking water supply. With the prospect of countless cases of typhoid due to contaminated drinking water and every reason to believe that such cases might occur, the number was comparatively few among people who had disregarded the warning of the authorities or were hopelessly ignorant of their danger and not in a position to boil even such water supplies as could be obtained. Never has the value of chlorinating drinking water supplies been so well demonstrated as during this disastrous overflow of the Mississippi.

When one remembers that the wholesale anti-typhoid innoculation which was given in the camps did not re-act until nearly a week after the last or third innoculation before immunity occurred, it will be readily seen the value of water sterilization cannot be overestimated. Few, if any, of the flooded towns escape damage to their water plants and widespread contamination of their drinking water and it was only by careful laboratory tests, all of which took time, that the safety of the water could be determined.

Simultaneously with instructions to boil water arrangements were made to chlorinate a quantity of water with hypochloride of lime, always easily obtainable even in the small town. This treated water was placed in containers easily accessible and instructions were given to obtain and drink water from these containers. This was followed by house-to-house instructions in the use of a furnished solution of chlorinated lime.

It was found that private wells of the drilled or driven type which were adequately protected at the top so that flood waters could not enter them continued to give a safe water. Dug wells were always regarded with suspicion and only under exceptional circumstances furnished a safe water.

Flooded wells should be chlorinated as soon as conditions allow, using an ounce of hypochlorite to each thousand gallons of well water, the chemical first being dissolved in a small quantity of water and then thrown into the well, mixing thoroughly by continued agitation. After half an hour the water may be considered as ready for drinking and safe for human consumption. As soon as the taste of the chlorine begins to grow faint, the dosage should be repeated. Cisterns should be treated in a precisely similar manner where there exists the least doubt as to the safety of the water.

The Illinois Central put out a bulletin containing instructions for the use of chloride of lime in the extemporaneous treatment of drinking water, directing the use of a "level tablespoonful" to a quart of water. This gives a 120 to 150 grain solution, one tablespoonful of which was added to ten gallons of water, thoroughly stirred and allowed to stand 20 min. to one-half hour before using.

The railroads faced a most serious condition involving not only the town and city public supplies from which drinking water must be obtained for laborers, but hundreds of isolated and moving groups had constantly to be furnished with safe drinking water, these being the army of men who worked on the immense task of repairing damages caused by the flood.

Early in the flood the railroads in the troubled territory issued instructions for sterilizing water from wells, cisterns or springs. As it is not always convenient or possible to boil a large amount of water, the use of hypochloride of lime may be substituted, this chemical being put up in sealed tins. One ounce of hypochloride of lime should be used to every thousand gallons of water to be treated, making about a two-part-per-million solution. If scales are not available an ordinary tablespoon may be used, two heaping tablespoons weighing approximately an ounce. Rub up the dry powder with a small amount of water to form a paste, carefully breaking up the lumps and adding enough water to make the paste of pouring consistency, then empty into a bucket of water, stirring constantly until thoroughly mixed. It is well to perform this operation out-of-doors or in a good draft in order to avoid inhaling the chlorine fumes which are evolved and which cannot be considered harmful or poisonous. Pour the bucketful of solution into the well and either stir with a clean board or raise and lower the well-bucket a sufficient number of times to mix the solution thoroughly with the well water; water from this well should not be used for about half an hour in order to allow sterilization to become thorough.

The following table has been devised to enable the field man to estimate rapidly the amount of water present in the well which is being chlorinated:

Diameter of well in feet	1	2	3	4	5	6	7	8
Gallons for each foot depth of water	6	24	53	94	147	212	288	376

The United States Army Medical Corps has found that two drops of 7 per cent tincture of iodine added to a quart of water will destroy all germ life in one-half hour, rendering the water safe for drinking purposes.

While much has been said concerning chloride of lime it is not the only chemical which may be used for water sterilization, there being several on the market which were used in the overflow with success and which are equally efficient, most of them, however, being dependent upon their chlorine content for sterilizant effect.

Appendix C—Pitting and Corrosion of Boiler Tubes and Sheets

In the absence of a progress report by the committee, monographs were presented by C. H. Koyl, of the Chicago, Milwaukee, St. Paul & Pacific, and L. O. Gunderson, of the Chicago & Alton, outlining certain more or less well-known principles of corrosion, and describing methods followed on those two roads in efforts to prevent pitting and corrosion.

The report by Mr. Koyl was presented under two heads, "Causes of Boiler Pitting and Means of Prevention in Neutral and Alkaline Waters," and "The Prevention of Boiler Pitting in Neutral and Alkaline Waters by the Exclusion of Dissolved Oxygen from the Feedwater."

Under the first subject Mr. Koyl summarized in non-technical language the advancing state of knowledge of pitting and corrosion. Under the second subject he discussed prevention practices. Abstracts from the monographs follow:

In 1918, on the Great Northern, the boilermen established the fact that in water slightly acid from any cause, either coal-mine, swamp or sewage, the pitting commenced at the hot end of the boiler and gradually worked forward until, sometimes, it reached the front end before the tube became useless. They noted also that in alkaline water the pitting commenced at the front end of the boiler and gradually worked back toward the hot end, sometimes reaching it before it was necessary to scrap the tube.

Before the water was treated on the main line, locomotive boiler pitting had been very bad, tubes lasting nine to ten months; after treatment was in operation there was still more than enough pitting, tubes lasting about two years. But soon the boiler men began asking me why these treated-water tubes were pitted only on the front half, because apparently both tubes and water were the same from end to end of the boiler; why there were no pits on the tubes near the back flue-sheet where, on account of touching the copper ferrules, pitting is expected to be bad, etc. I was unable to answer at the time, but it was evident that there was more to boiler pitting than the electrolytic difference of potential between hard spots and soft spots in steel, and between steel tubes and copper ferrules.

After many examinations of the feedwater the conclusion was reached that the only active content of the water as it enters the boiler is oxygen dissolved from the air. The originating cause of pitting is the difference of electric potential between parts of the metal, but in any except acid water an oxidizing agent is necessary to the continuation of the pitting because something must take the iron out of solution before the water is saturated, and something must combine with the hydrogen which otherwise would cover the negative places on the metal and stop the process.

Since it was very probable that the oxygen which would have pitted the back half of the boiler had gone

up into the steam-space by the time the water was halfway back to the firebox, it remained only to devise a means of depriving the feedwater of the principal part of its oxygen; and immediately the utilization of an open feedwater heater attached to the locomotive and heated by exhaust steam from the cylinders suggested itself. Such a heater would not only stop the pitting but would save $2,000 in coal per year.

Measurements at the Altoona laboratory showed that under ideal conditions such a heater extracted about 90 per cent of the oxygen. In April, 1925, on the Milwaukee, a locomotive with new tubes was fitted with an open feedwater heater and placed for test on one of our treated-water districts in South Dakota where formerly pitting was very bad, and where even with treated water and caustic soda averaging 40 grains-per-gallon between washings the tubes average only two years' service. For comparison, another engine with new tubes of approximately the same date, a mate in all respects except that it has no heater, has been on the same run.

At intervals of two months we have taken out a few tubes for examination from the locations where pitting is worst on other engines working on this district, and during the two-and-one-half years that the locomotive has been in service the boiler foreman has always reported "No pits; good for service."

During this time the mate engine has been pitting steadily, so that more than half its tubes are in the scrap heap.

Mr. Gunderson's Paper

The report of Mr. Gunderson was on the subject of "The Prevention of Pitting and Corrosion by Electro-Chemical Polarization." Part of this report:

For the past three years the electro-chemical polarization system of pitting and corrosion prevention installed on locomotives on the Chicago & Alton has successfully prevented all pitting and grooving or other forms of corrosion on flues, fire-boxes and shells of all boilers so equipped. This road has now 23 such installations with others under way in the shops for protection of the boiler materials in corrosive water districts. The ease and simplicity with which the system is installed in the boilers and the negligible maintenance and attention required, commend it for railroad service.

This system of protection is described essentially as follows: Two perfectly insulated electrodes are inserted in the boiler shell, one in the upper part of the boiler and one diagonally opposite in the lower part. The conducting members of these electrodes are rigidly connected to iron anodes which extend longitudinally practically the entire length of the boiler submerged in the boiler water, and which anodes are rigidly attached by insulated clamps to the boiler shell. Conduited insulated wires connect the electrodes to a shunt from the headlight turbo-generator, with suitable fuses and resistance in series to provide approximately 2 volts with two or three amperes to each electrode, making 0.001 to 0.002 ampere per square foot of protected surface. The negative pole of the generator is grounded to the boiler shell, which permits the current to travel in the circuit from anodes through the boiler water electrolyte, and through the boiler metal back to the negative pole of the generator. A soluble arsenic salt is added to the boiler water at the rate of two pounds for initial charge and one pound every two weeks while locomotive is in service. This permits the plating out of the arsenic "secondary cathode," which is the one important essential of the polarization effect which makes the system successful.

Appendix D—Sodium Aluminate as an Aid to Water Softening

In the plain lime-soda treating process, the magnesia in the water appears finally as magnesium hydrate, which is a very light precipitate and slow to settle. In difficult cases it has been the custom to add to the treatment from one to three grains per gallon of aluminum sulphate or ferrous sulphate so that the aluminum hydrate or ferrous hydrate formed in the reactions should weigh down the light particles of magnesium hydrate and cause them to settle more quickly. It has been found also that the addition of aluminum or ferrous sulphate has acted to free the softened water from the grain or so of calcium or magnesium carbonate which is slow to come out of solution in the settling tank and has caused endless trouble as "after-precipitation," which means coming out of solution later and forming scale in the pipe lines.

When sodium aluminate is used for this purpose instead of ferrous or aluminum sulphate, it is usually found that the results are both more speedy and more complete, and at last a plausible explanation has appeared in the statement that the alumina and the magnesia combine chemically to form the precipitate magnesium-aluminate which is heavy and settles quickly, and the reaction is so complete that it frees the water from the cause of "after-precipitation." About 1½ grains of sodium aluminate per gallon of water is used, and if there is not enough magnesia left in the water to satisfy the alumina then the balance of the alumina combines with calcium to form calcium aluminate.

In the use of sodium aluminate it is particularly recommended that the powder be not added to the water until after the lime has been added and thoroughly stirred in. The chemical reaction has not yet been solved, but in many waters the addition of the sodium aluminate with the hydrated lime has detracted seriously from the efficiency of the softening. Evidently there is considerable yet to learn concerning the action of this material in the lime-soda softening process.

Following the statements of the committee, the report included a paper by Paul M. La Bach, engineer of water service of the Rock Island, on the use of sodium aluminate on the Rock Island lines.

Appendix D-1—Foaming of Locomotive Boilers

An abstract of the committee's report is given in the following:

Of late years there has been some scientific study of foams with the discovery that a sufficiently stabilized film (tough skin) can be formed when water containing sodium salts in solution also contains in suspension such finely divided solid matter as precipitated sludge, comminuted scale, light mud, etc. So that in a boiler we may expect to find a true foam and its effect of wet steam even without the presence of soap or organic slimes if only the water contains both concentrated sodium salts in solution and fine solid particles in suspension.

As far back as 1919 the committee stated, "Foaming is due primarily to the presence of suspended matter in the water. The suspended matter gives a mechanical strength or tenacity to the liquid in the thin films encasing the steam bubbles, which, rising to the surface, retain their films and collect to produce foam. It is aggravated by the concentration of alkali salts present in the natural waters or added by the process of water softening, which increases the viscosity of the surface films."

In Professor W. D. Bancroft's book on "Applied

Colloid Chemistry," published in 1921, page 268, etc., appears this statement of essentials in foam formation: "To get a foam the only essential is that there shall be a distinct surface film, in other words, that the concentration in the surface layer shall differ perceptibly from that in the mass of the liquid."

In November, 1924, there appeared in *Industrial and Engineering Chemistry* a paper by Professor C. W. Foulk, of Ohio State University, which brought together all the information to date and gave the results of a long set of laboratory tests to settle disputed points and furnish the foundation for a theory of boiler foaming.

The conclusion from Professor Foulk's flask tests is that foaming commences when sodium salts in solution and finely divided solid matter in suspension each amount to 500 parts per million or 30 grains per gallon; that increase in foaming follows an increase in the amount of either soluble or insoluble material up to a maximum at 7000 parts per million or 400 grains per gallon. He finds powders more efficient the finer they are.

Professor Foulk points out that the solid particles must have a natural tendency to adhere to that kind of water if they are to be efficient in stabilizing the films which surround the steam bubbles; and he surmises that the pronounced efficiency of castor oil in stopping and preventing foaming is due to its reduction of the adherence between particle and water.

Accepting the above as a statement of the causes of boiler foaming with which all can agree, it yet remains for us to learn the upper and lower limits of sodium salt concentration which can be carried with each amount of sludge of a certain character in a locomotive boiler of a certain size, the locomotive doing a certain amount of work and with other operating conditions definitely stated.

This report was followed by a monograph on the cost of blowdown of locomotive boilers, by R. A. Tanner, Assistant Engineer, N. P., which consisted of a technical analysis of the determination of the blowdown point for any particular water. This concluded with the statement that pending further development in this field, it will be necessary to depend upon experience, with occasional experiments, to determine the blowdown point for any particular water, or for the mixture of waters usually encountered in the engine run.

Appendix D-2—Carbonate and Sulphate Waters—Influence on Operation and Maintenance of Boilers and Cost of Purification

After several general statements by the committee relative to the damage done to a boiler per pound of scale deposited, and the cost of repairs and extra fuel resulting from the average pound of hard scale deposited, the following, written by R. W. Chorley, was presented, on the comparative costs of purging carbonate and sulphate scaling matter from water.

"It is often found that boiler waters of equal degrees of hardess differ in the amount of damage which they do to boilers, and analyses of the waters show that in those doing the greater damage the proportion of sulphate to carbonate scale is the greater.

"The cause of the damage to the boilers is principally the insulating property of the scale which restricts the passage of heat from metal to water, causing overheating of the metal which results in warping, fire-cracking and rapid deterioration. Firebox sheets and other heating surfaces of a boiler are limited to definite thickness of metal. The steam pressure on boilers has been greatly increased in the past few years and the shells and other parts which are not heating surfaces have been proportionally increased in thickness, but side sheets and flue sheets and other heating surfaces have not been increased in thickness, the added strength being obtained by increasing the number of staybolts.

"Sulphate incrusting matter is more costly to take from water than carbonate incrusting matter.

"To precipitate in a settling tank and be entirely rid of calcium or magnesium bi-carbonate requires per grain of calcium carbonate only .56 grain of quick lime or .74 grain of hydrated lime, and per grain of magnesium carbonate only .67 grain of quick lime or .88 grain of hydrated lime.

"The sulphates of calcium and magnesium cannot be precipitated and gotten rid of by the lime-soda treatment but can merely be converted into sodium sulphate which does not scale but tends to foam, and the process requires .78 grain of soda-ash per grain of calcium sulphate or .88 grain of soda-ash *and* .88 grain of hydrated lime per grain of magnesium sulphate.

"With hydrated lime, at 0.6 cent per pound and soda-ash at 1.3 cents per pound, the cost of chemicals for treatment becomes:

Per pound calcium carbonate	0.44 cents
Per pound magnesium carbonate	0.52 cents
Per pound calcium sulphate	1.01 cents
Per pound magnesium sulphate	1.66 cents

"It should be noted that not only is sulphate water the more costly to treat but it is also more costly to use, because of the loss of water and heat due to the blowing-out necessitated by the concentration of sodium sulphate in the water in the boiler. In common practice each pound of dissolved sodium sulphate costs about four cents in blowdown water, and each pound of soft sludge and other matter in suspension costs about one cent unless blown out by the necessity for reducing alkali concentration."

Appendix E—Hydrants for Coach Yards and General Service and Methods for Supplying Water to Coaches

The work of the committee was divided under the three following heads:

1. Hydrants for coach yards and passenger station platforms where coaches are watered.
2. Methods of supplying water to coaches from hydrants, including care and handling of hose, nozzles and connections.
3. Hydrants for general service such as ash pits, stock yards, small stations and similar facilities.

Under the first head, (1) the committee reported that information received from representative railroads from all sections of the United States, shows that the most satisfactory types of hydrants for this purpose embody the following features:

(1) Hydrant should be placed in a pit or box the top of which is flush with platform or surface of ground. This feature removes the hazard of personal injuries presented by high top hydrants and also permits trucking on platforms and in coach yards.

(2) Quick opening type of valves should be used and hose connections which permit hose to be quickly attached or removed. The time for watering coaches in transit is usually limited and the saving in time effected by quick opening valves and easily manipulated hose connections is important.

(3) Except in localities where freezing weather is never experienced, the hydrants should be self-draining-non-freezing or adequately frost proofed.

(4) Adequate drainage should be provided to carry away surface waste as well as water drained from the hydrants. Ground drainage is seldom satisfactory. Pipe drainage is preferred. The proper method will depend on local conditions, the character of soil and frequency of use of hydrants.

(5) Hydrants should be so constructed and installed that repairs may be easily and quickly made without the necessity of digging.

(6) Construction of valves should be such that they will withstand hard usage and will not require frequent renewals to prevent waste of water.

Under this head it concluded that the most suitable type of hydrant for coach yards and station platforms is a quick opening, self-draining, non-freezing valve in a pit or box flush with the surface.

After discussing subject (2), it stated the following in conclusion: The method of conveying drinking water from hydrants to coaches through hose is satisfactory in practically every respect excepting the very important one of sanitation. No method of protecting nozzles and hose ends yet devised has proven entirely satisfactory since these devices cannot offset the evils of careless handling. Proper instruction and supervision of forces watering coaches will be more effective in promoting sanitation than mechanical devices.

Under subject (3) the following statements were made:

For use at stock yards, some type of high top hydrant is preferred. They should be rugged in construction and have no parts which can be easily damaged or removed. Where there is danger of freezing they should be of the self-draining type. Unless these hydrants are to be placed in a paved area it is not usually considered necessary to place them in pits although repairs can be much easier made if pit is provided.

Appendix F—Pipe for Service Lines, Three Inches and Under in Size

The report of the committee contained details with regard to the various kinds of service pipe in use, including galvanized wrought iron, galvanized wrought steel, lead, copper, brass, and cast iron, with its various types of prepared joints. It also contained reviews on pipe linings, and coatings, the present practices of railways and cities in the use of pipe, and a review of the costs of various kinds of service pipes.

The conclusions arrived at by the committee were as follows:

Conclusions

(1) Service pipe materials may be divided into two general classes: The ferrous materials, of which wrought iron, wrought steel and cast iron are examples, and the non-ferrous materials represented by lead, copper and brass. The ferrous materials are cheaper, but the non-ferrous materials are more durable under similar conditions of soil and water.

(2) Cast iron pipe is extensively used for large water mains and is generally more durable than wrought iron or wrought steel. It is now commercially available in 1¼, 2 and 3 in. sizes and we suggest that its use for permanent service lines in these sizes be considered.

(3) Extra heavy galvanized wrought iron pipe is suitable for service lines of a semi-permanent nature or for pipe sizes not available in cast iron. Galvanized steel may be considered where the installation is intended to last for a relatively short period.

(4) We do not recommend black wrought iron or steel pipe for service lines on account of the relatively lower durability and the tendency of the uncoated metal to rust and cause discolored water.

(5) Where service lines one inch, or less, in sizes are laid under pavements or in other locations where an indefinitely permanent installation is required we suggest the use of copper pipe, or brass pipe with 85 per cent copper content in preference to lead pipe for the reasons that such pipe is cheaper and stronger than lead, fully as durable, and easier to install owing to the absence of the "wiped" joint.

(6) The pre-calked joint for cast iron pipe in 1¼, 2 and 3 in. sizes is a convenience and economy over the older method of installing the molten jointing material in the field. While pipe users have not fully accepted it, we believe their reluctance is largely due to a natural hesitation in superseding an established process until someone else has fully tried out the newer method. We suggest small trial installations of pre-calked cast iron pipe in 1¼, 2 and 3 in. sizes by railways interested to fully test it.

(7) We do not recommend the use of any form of calked joints under railway tracks without encasement or other protection against vibration.

(8) The universal cast iron joint in two and three in. sizes should be considered for use in partially settled fills or in locations subject to vibration or movement where protective measures are not provided, as this class of joint will adjust itself to considerable disturbance without leakage.

(9) Where service pipe is laid in cinders or corrosive soils or where the water has an unusual tendency to corrode or incrustate a special study should be made to select the piping material and protective methods best suited for the conditions.

(10) It is our opinion that too many pipe sizes are now used for service lines and we believe that railways should limit these sizes to a suitable minimum.

Appendix H—Disposal of Sludge at Water Softening Plants

Analysis of the material in sludge from water treating plants on a water-free basis, shows that it consists principally of calcium carbonate, with varying percentages of magnesium hydrate.

The general method of its disposal, wherever possible, is to allow it to drain out of the plant onto low ground or into a creek or moving body of water. Where this is not practical, it is necessary to construct pits to retain the sludge until such time as these pits are cleaned by clamshell or other means at considerable expense.

In many cases the sludge is simply dumped along the right-of-way or allowed to accumulate in piles which are scattered to some degree by the wind. Some railways have specially designed sludge disposal cars. These are made out of a tank car, putting 8-in. quick-opening gate valves in on opposite sides of the car, near the bottom towards each end.

Some of the uses to which sludge has been applied with varied success are:

Reburning.—Reburning the sludge to convert it back to calcium oxide results in a recovered calcium oxide of poorer quality than the original commercial product. The expense incurred in hauling the sludge to a central point prohibits the extensive use of this method.

Whitewash.—This sludge is not as economical or as efficient as the ordinary commercial lime sold for this purpose. It can, however, be used as a "filler" for the whitewash as well as mortar.

Chalk and Toothpaste.—A small quantity of the sludge has been used in the manufacture of chalk. The commercial raw materials at present used for these products are far superior to the sludge.

Fertilizer.—This appears to be the only economical method of disposal of this material where sludge pits are necessary. It is an excellent antidote for "sour land."

It is the opinion of the committee that the most economical method of disposal of this sludge is to allow it to drain onto low land or into a moving body of water. At points where pits are necessary, a united effort should be made to interest agricultural agents in the use of this material as a fertilizer, allowing them to take it away at their own price.

Appendix K—Spacing of Water Stations in Connection with Increasing Capacity of Engine Tenders

A summary of the report of this committee is given in the following:

(1) Determination of the economical size for water capacity in engine tenders can be developed by consideration of the operating requirements on the respective individual engine district on freight sub-division, with view of effecting maximum available increase in gross ton miles per train hour by the acceleration of train movement and elimination of delays caused by stops for water.

(2) The decision as to most suitable engine tender capacity will govern the water station spacing which should be handled with view of expediting regular operation and providing sufficient margin of safety to take

care of emergencies and prevent delays from water shortage.

(3) Due to the many variable factors influencing operation and train movement throughout the country, your committee does not feel that general rules can be formulated at this time for universal application, and recommends that careful study be made of the individual districts under consideration for determination of the possible economies available.

Discussion

[Chairman C. R. Knowles (I. C.) presented the report by having each subcommittee chairman outline the work done. The first report was that of the subcommittee on drinking water control during the Mississippi flood, presented by the chairman, Dr. S. C. Beach (I. C.).]

Dr. Beach: The report emphasizes the work done by the railroads not only of an emergency nature, but of a rehabilitory nature. I wish to call particular attention to the work done by the engineers in this flood. They were first in the field on the question of water sterilization and protection of water supplies.

[The report was received as information without discussion following which work of the subcommittee on corrosion was outlined by its chairman, C. H. Koyl (C. M. St. P. & P.).]

Mr. Koyl: The two monographs comprising this year's report establish that we are getting on solid ground as to the causes of corrosion. The first monograph tells the story of the two and one-half years' test which has been successful in preventing pitting. We put an open feed water heater on the outside of the boiler, force the water to go through that, and lose its gas before it goes to the boiler. The second method outlined by L. O. Gunderson (C. & A.) on artificial protection is shown in the second monograph.

[The monographs were received as information with discussion, following which Mr. Koyl presented monographs on the use of sodium aluminate by P. M. La Bach (C. R. I. & P.) and the cost of blowing down boilers by R. A. Tanner (N. P.) comprising the report on the value of water treatment.]

Mr. Koyl: The substances usually used for the purification of water for boiler purposes are fresh lime and soda ash, but there is always a little remnant which is difficult to dispose of. To take this out we have used various substances of which the dry sodium aluminate referred to in the paper appears to be the most efficient for its cost. It takes out of the water nearly all of the material which usually causes after-precipitation, that is, which comes out in the pipes during the next day or two, or comes out on the sand grains of the sand filter.

[This report and also the report on foaming and the effects of sulphate and carbonate scales were received as information without discussion, following which sub-committee chairman J. H. Davidson (M-K-T) outlined the work done on hydrants.]

Mr. Davidson: We have shown types of hydrants and hydrant valves and accessories that have been given severe service tests, and which when properly installed, will do away with the considerable waste of water evident with a great many hydrant installations now in this service. In conveying water from hydrants to coaches, it was practically impossible to design a device that would protect the ends of the hose against pollution. So far we have not been able to get hold of any device which cannot be rendered almost useless by improper and careless handling.

[This report and the report subsequently presented by the sub-committee chairman J. P. Hanley (I. C.) on service pipes were also received without other than introductory remarks by the chairman, following which R. E. Coughlan (C. & N. W.) presented the report on sludge disposal.]

Mr. Coughlan: The disposal of sludge at water softening plants has been more or less of a nuisance. We don't want the sludge and nobody else wants it. In an endeavor to find out what to do with it we canvassed roads and municipalities operating lime and soda ash softening plants in this country and Canada. We find that the most economical method is to allow it to run out of the plant upon low ground, or into some kind of a pit. We found that one city was reburning this lime to reconvert it back to hydrate lime. The objection to this is the expense of hauling the material to a central place. The finished product is not as good quality as the original raw product, and it costs more to make it that way than it would be to buy the original material. It has been found that we can use it as a filler for whitewash, but very little could be used in this way. Chalk manufacture was also investigated, but the raw products now used for this material make a much better and cheaper product so the only recourse is to get agricultural colleges and farmers to use as much of the material as possible to put over their land to act as a fertilizer.

[The report was received as information without discussion whereupon the report on spacing water stations was presented as information by the subcommittee chairman R. C. Bardwell (C. & O.) with explanatory remarks.]

J. M. Farrin (I. C.): The report says the approximate coal waste will average about one-half ton per stop. I think it will average about 500 lb.

Mr. Bardwell: That figure was used there in connection with a hypothetical case. The tests made have shown the actual coal waste in some cases to be more and in some cases to be less. The figure used we feel is conservative for the purposes. It is true there will be many cases where the losses in fuel will not reach that figure, and again there will be other cases, especially where you are hauling heavy tonnage trains, where the fuel waste will be considerably more.

Mr. Farrin: I still think the report is wrong. I am giving my information from actual tests. I know that a half ton is too much coal. In fact, 400 lb. would be a better average than the 500 that I suggested. The average train, say 3,500 tons, will consume between 400 and 500 lb. of coal in making a stop.

Chairman Knowles: The committee was dealing with trains of 10,000 tons.

Mr. Farrin: There are very few trains of 10,000 tons in the United States today. That is not the average train.

E. W. Metcalf (M-K-T): It seems to me that the committee has not exhausted the possibilities of study on this subject which may produce information of value. While it is true that the problem is one which varies with conditions and requirements, is it not possible to give something more definite as to what the problem is and how we should go to work to solve it? How much work on the average

should a locomotive do on 10,000 gal. of water? To what extent does the consumption of water vary with gradient, with tonnage hauled, with stops made? For given conditions and comparing tanks of different capacities, how may the safe and economical spacing of water stations be determined, giving the proper weight to the cost of stopping trains, of constructing, maintaining and operating the water stations, and of transporting and maintaining locomotive tenders? We ought to know these things. A practical example of the solution of such a problem, even though it might not fit our particular case, would give us a more definite idea on how the solution should be undertaken. I believe there is room for a substantial saving on many roads from the use of the larger tender tanks, through the elimination of entirely unnecessary and extra train stops, or even of water stations. I should like to see the subject continued.

L. Yager (N. P.): Speaking for the Committee on Outline of Work, we have just realized the major portion of this committee assignment involves economics of railway operation. The discussion brought out by Mr. Farrin indicates that very clearly. That is the line of work that committee has been doing and we are making the suggestion in the assignment of this subject, for close co-operation with Mr. Farrin's committee.

The President: The Committee on Outline of Work will take these matters under consideration.

[Without further discussion the committee was excused with the thanks of the association.]

Report of the Committee on Ties

W. J. Burton (M.P.)
Chairman

F. T. Beckett (C.R.I.& P.)
R. S. Belcher (A.T.& S.F.)
F. J. Bishop (Ann Arbor)
M. S. Blaiklock (C.N.R.)
W. C. Bolin (B.& O.C.T.)
H. F. Brown (N.P.)
H. R. Clarke (C.B.& Q.)
S. B. Clement (T.& N.O.)
R. L. Look (C.of Ga.)
E. L. Crugar (I.C.)
H. A. Hampton (S.P.)
R. S. Hubley (G.N.)
P. B. Jeffries (I.C.)
J. E. King (C.& O.)

W. J. Burton

John Foley (Penna.)
Vice-Chairman

C. S. Kirkpatrick (G.C.L.)
M. F. Longwill (Wab.)
W. F. McDonald (C.M.St.P.& P.)
A. F. Maischaider (C.C.C.& St.L.)
L. T. Nuckols (C.& O.)
H. B. Reinsagen (N.Y.C.)
J. H. Roach (N.Y.C.)
J. S. Ruff (N.Y.,N.H.& H.)
H. M. Tremaine (N.P.)
J. W. Williams (W.P.)
R. W. Willis (C.B.& Q.)
W. W. Wysor (U.R.& E.)
R. C. Young (L.S.& I.)

THE REPORTS submitted by the committee covered the following subjects:

(1) Revision of Manual (no recommendation).
(2) Anti-splitting devices (Appendix A).
(3) Size of hole for pre-boring (Appendix B).
(4) Extent to which specifications are being adhered to. (No report this year.)
(5) Renewal of switch ties (Appendix C).
(6) Report on substitute ties (Appendix D).
(7) Method of marking ties to indicate acceptance. (No report this year.)
(8) Methods of tie acceptance inspection. (No report this year.)
(9) Traffic unit for use in comparing cross-tie life (Appendix E).
(10) Data on average ties renewed per mile of maintained track (Appendix F).

The committee recommended:

(1) That the report on anti-splitting devices be received as information.

(2) That the report on the proper size of hole for pre-boring be received and the recommendation adopted for the Manual.

(3) That the report on the renewal of switch ties be received as information this year with the understanding that a recommendation based on the report will be submitted for inclusion in the Manual next year.

(4) That the report on substitute ties be received as information.

(5) That the report on traffic unit be received as information this year with the understanding that a recommendation will be submitted for inclusion in the Manual next year.

6. That the report on average ties renewed per maintained mile be received as information.

Appendix A—Anti-Splitting Devices

During the year the committee extended its study of anti-splitting devices, testing several types in a machine of the Pennsylvania at Altoona, to the point of failure of either the irons or the wood.

The tie sections used in these tests were cut to 14 in. length, care being taken to eliminate knots as much as possible. A ¼ in. slot was cut from one end of the block to within 3 in. of the other end. The irons were then pressed into the end of the block so that they extended across the slot and were separated sufficiently to admit the wedge which was used to split the tie. This wedge was 3¼ in. wide, with a 45-deg. point. When pressing the wedge into the tie, the sides of the slot in contact with the wedge were faced with greased sheet iron in order to reduce the effect of friction.

In making the test, the wedge was forced into the slot by the movable head of a testing machine, the

stretch of the block across the slot being observed at each 1000-lb. increment of load as registered on the testing machine, until maximum load was reached. In all, 12 different types, or arrangements, of irons were tested, 3 samples of each type being used.

Conclusions

(1) An anti-splitting device should be straight where it crosses the split or check, rather than curved. (2) It should cross the split at right angles. (3) "S"-irons with a small perpendicular lug at the end have more holding power than the standard "S"-irons. (4) The holding power of a device with a right-angle bend supported by an end lug is slightly in excess of the standard "S"-iron with end lug.

The committee felt that the information derived from its tests is not sufficient to permit definite recommendations as to the size and type of irons and therefore no recommendation was made this year.

Appendix B—Size of Holes for Pre-Boring

The committee submitted the following report of E. E. Chapman, engineer of tests of the Sante Fe, who assisted the committee in the tests made.

Size of Hole to Bore for Track Spikes

The object of the tests made in connection with this subject was to ascertain the proper size of hole to bore in cross-ties before treating for $\frac{9}{16}$ by 6-in. and $\frac{5}{8}$ by 6-in. cut spikes, as determined by the resistance of the spikes to vertical pull and horizontal thrust when driven into various sizes of holes.

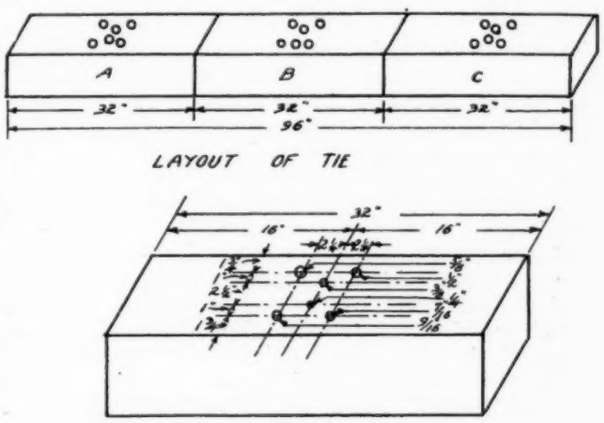
Tests were made to determine the holding power of $\frac{9}{16}$-in. and $\frac{5}{8}$-in. spikes in ten kinds of wood, untreated, creosote treated, and creosote and crude oil mixture treated. The following woods were supplied for this test from Someville, Texas: red oak, hewn ties; red gum, sawn ties; black gum, sawn ties; close-grained short leaf pine, hewn ties; and wide-ring loblolly pine, hewn ties. Other woods, secured from Albuquerque, N. M., included: New Mexico pine, hewn ties; red spruce, hewn ties; Engleman spruce, hewn ties; and corkbark fir, hewn ties. Douglas fir, sawn ties, were secured from National City, Calif.

Thirty ties of each of the above were supplied, ten of which were fine grain, ten medium grain, and ten coarse grain. The hewn ties had the heart at the center and the sawn ties were what are known as half cut ties. Before they were received for test, the ties were cut in three parts, numbered and bored. One-third was left untreated, one-third was treated with 5-lb. of creosote per cubic foot, and one-third treated with 8 lb. per cubic foot of 50-50 mixture creosote and oil. Both treatments were of the Rueping process.

In order to determine the maximum vertical force required to pull the spikes after being driven into the various sizes of holes, the tie was laid across the fixed head of the testing machine and the spikes pulled with a hook fixed to the moving head. Six ties of each treatment were used, two of fine grain, two of medium grain, and two of coarse grain being selected. As far as possible, corresponding thirds of the same ties were used in making the tests on the untreated, creosote treated, and mixture treated ties. In driving the gage was used and all spikes driven until the heads were $\frac{7}{8}$ in. from the tie, which had been found to approximate track conditions. In order to split the tie as little as possible, spikes were driven into the $\frac{5}{8}$, $\frac{9}{16}$, $\frac{3}{8}$ and $\frac{1}{4}$-in. holes at one time and these spikes pulled before driving spikes into the $\frac{1}{2}$-in., $\frac{7}{16}$-in. and no hole. A pulling speed of 0.2 in. per minute was used to start the spikes.

In determining the resistance to horizontal thrust, the tie was placed on end on the fixed head of the testing machine and a load applied to the throat of the spike through a $\frac{3}{4}$-in. plate attached to the moving head. Deflection of the spike was measured by an extensometer attached to the moving head and connected with a wire to a nail driven in the tie. With this arrangement, all movements between the tie and the fixed head were eliminated from the extensometer reading. An initial load of 200 lb. was applied and the extensometer set at zero. Readings were taken at 500-lb. increments of load. Three ties were selected for the test having one of each type of grain. Spikes were driven to gage as in the pull test.

After pulling the spikes, the ties were sawed and split through the spike hole so as to note the effect of the spike in the fiber. Photographs of representative fiber deformation for the untreated, creosote treated and mixture treated wood were made and accompanied the report. After the side-thrust test, a number of the ties were sawed and split in order to show the character of the deformation of both wood and spike. Photographs of these cross-sections formed a part of the report.



Detail
Sketches Showing Location and Size of Holes

Observations

In driving the spikes for this test, it was difficult to make the spikes follow the holes, particularly in the $\frac{1}{4}$-in. and $\frac{3}{8}$-in. holes. In the larger holes, the spikes had a tendency to twist while being driven. Due to the arrangement of the holes, very few splits were encountered. Spikes were not driven in holes bored through splits or visible knots. In all woods, the starting load was the maximum load.

In analyzing the data on the resistance to vertical pull, a series of graphs were made in which maximum pull was plotted against the size of holes. A study of these curves shows the untreated wood to have a more defined curve with the more definite placing of the correct size of hole to give maximum pull. The curve for the mixture treated wood in most cases is the more indefinite as to the correct size of hole to bore.

The lubricating effect of the treatments reduces the holding power of the spike in most cases excepting New Mexico pine and loblolly pine. In these woods, the creosote treatment increases the holding power of the spike, probably due to a toughening of the brittle fibers of these woods.

As it is considered impractical to determine upon the correct size of hole for each wood, the woods were grouped into hard and soft classes. The summary of the data for the three hard woods used in this test, viz., red oak, red gum, and black gum, and for the remaining seven woods which were classified as soft woods was shown in the report by tables and charts. Due to difficulty in making the spikes follow the ¼-in. and ⅜-in. holes, these sizes of holes are deemed too small for practical use. A study of the data with this in mind shows the correct size of holes for maximum pull hard woods to be $\frac{7}{16}$-in. for the $\frac{9}{16}$-in. spikes and ½-in. for the ⅝-in. spikes. For the soft woods, $\frac{7}{16}$-in. diameter gives the maximum pull for both $\frac{9}{16}$-in. and ⅝-in. spikes.

Analysis of the data on resistance to horizontal thrust required a series of graphs in which horizontal thrust was plotted against deflection. This gave a stress-strain curve for each size hole from which the load at yield point with its accompanying deflection was determined.

A study of these data shows no great variance between load and deflection with no hole, and load and deflection when spike is driven into ⅝-in. hole. As in the case of the vertical pull, the woods were classified and average stress-strain curves drawn for the hardwoods and softwoods. Averaging the untreated, creosoted treated and mixture treated woods, it is found that for the $\frac{9}{16}$-in. spikes, the $\frac{9}{16}$-in. hole has the highest load at yield point for both hard and soft woods. For the ⅝-in. spikes, the ⅝-in. hole takes the higher load, for the hardwoods, and there is practically no difference with the ½, $\frac{9}{16}$, and ⅝ in. holes for the softwoods. However, there is such small variation between the load at yield point for the various sizes of holes that for all practical purposes the size of hole can be governed by the size of holes giving the highest holding power to the spikes in vertical pull.

A study of the distortion of wood fibers in the various kinds of wood shows the deformation in the red oak and red gum to be very regular and smooth. The fibers have a tendency to straighten after the spike is withdrawn. The deformation in the black gum is similar to that in the red gum, but not so regular, and there are considerable broken fibers where spikes were driven with no holes.

The deformation in the close-grained shortleaf pine is rather irregular with short bends and many broken fibers in the coarse grained wood. In the loblolly pine the fibers are torn, crushed and broken with very little bending. Deformation in the New Mexico pine and red spruce is very similar. Both have short bending of the fibers close to the spike. The fibers are crushed and broken, particularly in the New Mexico pine. In the Engleman spruce and corkbark fir there is very little bending of the fibers, but the wood is torn and broken even where the spikes were driven in the smaller sizes of drilled holes. The fiber was so badly torn that it was difficult to secure a representative cross-section of the hole. In Douglas fir the deformation is very regular with long bends and no broken fibers.

A comparison of holding power of the spikes and the deformation of wood fibers shows the lowest holding power in the woods having the most torn and broken fibers. Lowest holding power is in Engleman spruce and corkbark fir and the highest in red oak. A study of the distortion of wood fibers in the various sizes of holes shows the disturbance of fibers to be much less where spikes were driven in holes $\frac{7}{16}$ in. in diameter or larger. It was also noticed that treatment is not nearly so thorough in case of the ¼-in. and ⅜-in. drilled holes as in the larger holes. Cross-sections of the wood and spike after the thrust test show that there was practically no distortion of wood or spike due to horizontal thrust deeper than one inch below the surface of the tie.

The tests made involved more than 5,000 individual tests. Particular attention was called to the photographs showing damage to the wood fiber, which is greater where no holes are bored or where the holes are too small. The benefit from pre-boring is, therefore, not only in the added resistance to withdrawal and side thrust, but also that due to the greater freedom from damaged wood fiber and the resulting rapid deterioration of the tie.

One feature developed by these tests which should have further attention is the design of the point of the spike. It was found that the ordinary chisel pointed spike does not follow the hole as well as desirable, and the committee, therefore, recommended this subject for further investigation. Tests so far indicate that a modified chisel point may be desirable, in which the chisel edge is slightly less than the diameter of the hole. Such a spike will not only follow the bored hole but can be used where holes have not been bored, and when spikes must be driven into tie plugs.

While the committee did not consider the question of the size of spike as included in its assignment, attention was called to the fact that these tests would indicate little, if any, advantage from the ⅝-in. spike as compared to the $\frac{9}{16}$-in. This more particularly as regards withdrawal tests.

The only suggestion coming to the attention of the committee which would indicate that holes should not be bored entirely through the tie is from a direct current electric line having covered tracks. Under these conditions, it was found after a few years that the spikes were badly corroded, due to electrolysis, the theory being that a comparatively low resistance path was formed for the return current from the bottom of the spikes through the holes to the sub-soil. This, however is a condition peculiar to the street railways, no such trouble having been noticed on electrically operated steam railways so far as the committee is aware.

Conclusions

(1) The less the distortion of the wood, the greater the resistance of the spike to horizontal thrust. (2) There is the least damage to the fiber when the largest hole is used. (3) For hardwood ties, the greatest resistance to withdrawal results with a hole slightly smaller than the largest. (4) The ¼-in. and ⅜-in. holes are too small for use with chisel pointed spikes. (5) The chisel pointed spike is unsatisfactory for driving into bored holes because of the tendency of the sharp corners to lead the spike away from the hole.

As a result of its conclusions, the committee recommended: (1) That holes for cut spikes in hardwoods be $\frac{1}{16}$-in. smaller than the diameter of the spike; and (2) That holes for cut spikes in softwoods be ⅛-in. smaller than the diameter of the spike.

Appendix C—Renewal of Switch Ties

Renewal of switch ties out of face (complete set) usually takes place when 50 per cent or more of the ties are unserviceable. The remaining ties would have remaining lives of from one to six or seven years approximately. Considering those having a remaining life of from one to three years the tendency would be to scrap rather than store them for future use. If they were to be used again, a 12-foot tie may have to be

used instead of a 10-foot tie on account of not having complete sets. In this case the 12-foot ties would have to be cut shorter and re-adzed which would mean a loss of material and an additional labor cost.

Owing to the fact that the ties under the switch point and frog wear out sooner than the others, there would be a surplus of intermediate ties salvaged when the out of face method of renewals is used. When the out of face renewal method is used, consider the switch ties in a No. 10 turnout, having 16 years average life, 10 per cent will require renewal each year, beginning with the eleventh year and completing with the twentieth year. Under this method, needed renewals might be postponed until the end of the fifteenth year, when 50 per cent of the ties would be unserviceable. The remaining 5 per cent of the ties having a total of 99 tie years life yet remaining would then be taken out. The average tie for the set would cost $6.30; the annual cost would be $0.64; the loss in material at each renewal would be 99 times $0.64 = $63.40.

The labor cost of applying the average tie of this No. 10 set is $0.70 by out of face method; by the method of individual renewal, it is $1 per tie. The saving in labor per renewal of the set is $0.30 by 66 = $19.80. The loss in both labor and material by the out of face method is $63.40 less $19.80, or $43.60.

From the standpoint of economy, out of 28 railroads canvassed, 8 recommended the out of face method, 12 recommended the individual method, 8 were conditional. The tendency in renewing out of face is to let conditions get bad enough to justify it, which is contrary to safe practice. In general the individual method is the best economically, because of the saving on material and labor, and better from a safety standpoint, and because of the more uniform maintenance it provides an easy riding track at all times.

Appendix D—Substitute Ties

Without making recommendations, the committee again presented a summarized statement of the records of tests on substitute ties being used by a number of roads. No new substitute ties were brought under observation during the year, so that the report serves mainly to keep up to date the records of the installations under test.

Appendix E—Develop and Recommend a Traffic Unit for Use in Comparing Cross-Tie Life

In selecting the unit, consideration has been given to available statistics. It is the thought of the committee that the average renewals per maintained mile, adjusted for differences in average traffic, will give the most nearly correct comparison of the results of the cross-tie practices and policies of individual carriers which can reasonably be made. The committee recommends as this unit the "equated gross ton miles per mile of equated track per day." This unit is derived by dividing the "total annual equated gross ton miles" by 365 and multiplying by the "equated miles of track maintained."

The "total annual equated gross ton miles" is the sum of the following items:

A = Gross freight ton miles, including locomotives and tenders.

B = Equated gross ton miles of passenger cars.

C = Equated gross ton miles of passenger locomotives.

A = "Gross ton miles including locomotives and tenders" are given as Item (8) I. C. C. Form OS. A.

B = "Passenger car miles" times the average weight of passenger car times the factor for greater speed of passenger trains over freight trains. Passenger car miles are given in Mileage Statistics of Annual Report. We can assume 60 tons as the average weight of passenger car and the speed factor as 2½. We then have B equals "passenger car miles" times 150.

C = "Passenger locomotive miles" times the average weight of passenger locomotive times the speed factor. "Passenger locomotive mileage" is given in the Mileage Statistics of Annual Report. Average weight of locomotive in working order can be arrived at approximately by taking the tractive effort (shown as Item 2. A. 2 I. C. C. Comparative Statement of Operating Averages) and multiplying this by 12. We then have C equals "passenger locomotive" times tractive effort divided by 2000 times 12 times 2½; or, "passenger locomotive miles" times tractive effort divided by 67.

Let D = "equated track miles maintained," which is shown as Item 1. D in the I. C. C. Comparative Statement of Operating Averages.

The traffic unit, that is, the "equated gross ton miles per equated mile of track maintained per day"

$$= \frac{A + B + C}{D \times 365}$$

This unit would be comparable on all railroads unless it is unbalanced too much by traffic hauled over that part of a railroad operated under trackage rights. This difference is very largely compensated for by the traffic burden that is put on the railroad by other railroads which have trackage rights.

Appendix F—Report Data on Average Ties Renewed Per Mile of Maintained Track

A careful investigation of the data available up to 1926 indicates that because of complications between "operated" and "maintained" mileage, and for other reasons not necessary to repeat here, results derived for representative roads would be from 1 to 26 per cent in error. As the statistics in the revised form recommended by the committee will be available from 1927 on, it has been thought best to defer the first report on this subject until next year.

Discussion

[In the absence of the committee chairman and vice-chairman, the report of the committee was presented by R. S. Belcher (A. T. & S. F.) secretary of the committee. E. L. Crugar (I. C.) submitted the report on anti-splitting devices which was received as information. Mr. Belcher presented as information the subject matter on the size of holes for pre-boring, and *moved that the recommendation of the committee in Appendix B be included in* the Manual.]

C. C. Cook (B. & O.): I think the conclusions are in error if they are based upon the data given in the table. It says, "For hardwood ties, the greatest resistance to withdrawal results with a hole slightly smaller than the largest." I don't find any data to support that.

Mr. Belcher: The recommendations are perhaps not entirely in acord with the bare figures of the test as to the resistance to withdrawal and the resistance to horizontal thrust, but we must consider the distortion of wood fiber as shown by the pictures which are also a part of this report, and the fact that in driving the spikes for this test it was difficult to make the spikes follow the bored holes, particularly smaller ones.

A study of the data on resistance to horizontal thrust indicates for a 9/16-in. spike a 9/16-in. hole has the highest load at the yield point, for both hard and soft

woods. For the 5/8-in. spike the 5/8-in. hole takes the highest load in the hard woods and there is practically no difference with the 1/2-in., 9/16-in., and 5/8-in. holes in the soft woods.

[A number of other questions were raised concerning the report on this subject and after some discussion it was concluded to refer it back to the committee for further study. Mr. Belcher then introduced W. C. Bolin (B. & O.) who presented the report on the renewal of switch ties. He read a letter from C. A. Morse (C. R. I. & P.) criticising the report and expressing the opinion that the report was drawn without a thorough knowledge of practice with respect to renewals out of face. This letter and remarks by C. W. Baldridge (A. T. & S. F.) were accepted by the committe as helpful in further study of the subject. After offering the matter on substitute ties, Mr. Belcher introduced A. F. Maischaider (C. C. C. & St. L.) who presented Appendix E on a traffic unit for comparing cross-tie life.]

H. C. Crowell (Penna): Under the head of method of deriving the traffic unit, I would like to invite the committee's attention to the fact that the proceedings for 1925 gave a formula for equating traffic. This formula, by the way, is the famous Yager or Committee XXI formula. Before the committee disregards the formula that is already in the proceedings and in the Manual, I think they should show why the factors offered are better than those of the older formula.

[He also objected to the method of deriving the traffic unit and the method of its use. To this, Mr. Maischaider rejoined that the committee was handicapped by a lack of suitable statistics, particularly as to the number of ties maintained for equated track miles.]

Vice-president Louis Yager (in the chair): This is a very important subject. It is one of the most important elements of maintenance and the question is often asked how are you to account for the factor of a difference in use to which the ties are subjected. The committee is very grateful for the suggestions which have been offered, particularly by Mr. Crowell, and it will endeavor to reconcile these differences which he has pointed out.

[The committee was then excused with the thanks of the association.]

Report of Special Committee on Standardization

W. C. Cushing (Penna.)
Chairman

J. E. Armstrong (C.P.R.)
C. W. Baldridge (A.T.& S.F.)
Hadley Baldwin (C.C.C.& St. L.)
W. C. Barrett (L.V.)
F. L. C. Bond (C.N.R.)
W. J. Burton (M.P.)
J. M. Farrin (I.C.)
Robert H. Ford (C.R.I.& P.)
Paul Hamilton (C.C.C.& St.L.)
J. H. Hande (B.& O.)
W. E. Hawley (D.M.& N.)
J. C. Irwin (B.& A.)

W. C. Cushing

J. R. W. Ambrose (Tor.Term.)
Vice-Chairman

F. R. Judd (I.C.)
E. B. Katte (N.Y.C.)
C. R. Knowles (I.C.)
F. R. Layng (B.& L.E.)
B. R. Leffler (N.Y.C.)
F. E. Morrow (C.& W.I.)
J. V. Neubert (N.Y.C.)
W. M. Post (Penna.)
A. N. Reece (K.C.S.)
C. P. Richardson (C.R.I.& P.)
F. C. Shepherd (B.& M.)
Earl Stimson (B.& O.)

THE WORK of the committee for the year has been confined to the collection of information relating to matters of "recommended practice" and "national standardization," and the report is presented under these two captions.

Recommended Practice

The presentation of statistical information of the results of research work into scientific and technical problems, and of statements of variable practices of members concerning important details of construction and maintenance forms a large and important division of the activities of the association in addition to the praiseworthy effort for the establishment of "recommended practice," and the elimination of waste in manufacture by simplifying practice, thus bringing about reductions in stocks and forms, moulds, patterns and rolls.

At a meeting of the committee on June 17 the main discussion fell upon the distinction between standardization of materials and the impracticability of placing technical design in that category. The view was taken that technical design such as that of bridges, buildings, etc., should not be a subject of standardization, and sympathy with that view was expressed, but at the same time it was necessary to recognize that it was possible to come to a common understanding concerning certain features in connection with bridge and building design, and attention was called to the fact that standardization, even in connection with bridges and buildings, dealt with materials, their strength and use, rather than details of mechanical and engineering design.

Attention was called to the fact that one of the useful lines of standardization work was the establishment of codes, both safety and structural. In certain cases, and particularly in the case of buildings which are built in many different cities under many different codes, these codes are so variable and contrary to each other that a building built under the code of one city should by rights fall down when built under the code of another city, and several

cities were named, such as Memphis and Galveston, where such codes are markedly different. Several members stated that much could be accomplished by having more unified practice in connection with building codes, and the view also was expressed that the technical societies have a good influence in that work. The outcome of the discussion was that this subject of technical design requires careful judgment in each case.

The field for simplification of general sizes, dimensions and styles, and for standardization in quality of materials and their application, with methods of conveying information in the case of country-wide use, is very large, and in the latter connection it was pointed out that things having a very enlarged scope are the questions of highway crossing signs, efforts at simplification of which should be put forward at all times by members of the Association.

In dealing with the subject of national standardization it was pointed out that we need not be so concerned about the outside world as with our own internal work within the A. R. E. A. It was stated also that we should adhere to the policy already expressed of not attempting to place too many of the A. R. E. A. standards under the jurisdiction of the A. E. S. C. as being unnecessary and likely to arouse complications because of the almost exclusive interest of the A. R. E. A. in those particular subjects. Unless a standard is really of national scope there would be no justification for putting it under the aegis of the A. E. S. C. In this connection attention was called to the difficulty had in the procedure of revising a national standard once established.

It was recognized also in this discussion that it is impossible to force the adoption of a standard by individual members of any association, but while it is recognized that the members of the A. R. E. A. should make the most use possible of the recommended practice of the Manual, nevertheless such use will not be made unless the recommended practice proves its own value for the purpose. No member will make use of practice recommended by a society, which as often happens is a compromise recommendation, unless its value is so outstanding that he will find it of great use to himself and his company, and, therefore, it is necessary in the preparation of reports and when requesting the adoption of recommended practice that the work be done with the utmost care and that after approval it be kept up to date constantly, and that is the work of each committee and its members. Some of the difficulties in connection with work of this kind were pointed out wherein it was stated that reinforced concrete dealers are constantly endeavoring to have the committee place their materials on the same basis as structural steel, while the steel dealer complains that concrete codes are entirely too favorable to that material, and another committee finds that certain industrial agencies have been working against the idea of the building code.

An effort has been made by each chairman of a committee to ascertain to what extent these recommendations have been made use of by the members of his own committee. There are three degrees of use for which the dogma of "recommended practice" are available, or adaptable for appropriation in one's own specifications or instructions:

1. Adoption verbatim, or nearly so, of the plans, specifications, instructions or rules.
2. Incorporation of the fundamental or main items of importance in settling upon and maintaining unification of methods.
3. Acceptance of the general influence of the data, and citations, in order that one's own practice may be in general accord.

From insufficient information it has been rather difficult to give the association a complete view of the progress made in the effort for standardization and simplified practice. It is gratifying to learn of the degree of the value of the committee industry by answers like that of the Missouri Pacific—"Probably 70 per cent of standard plans, specifications and practices are American Railway Engineering Association or close thereto."

Following this part of the report, there was presented summarized statements concerning the work of each standing committee of the Association, and the extent to which its recommendations are being adhered to by the various railways.

National Standardization

The A. R. E. A. liaison with national standardization is by membership of the American Railway Association as one of the 24 member-bodies forming the American Engineering Standards Committee as shown in the 1926-1927 report of this committee.

The membership representative is Division IV—Engineering, subdivided into three sections:

(1) Construction and maintenance section (A. R. E. A.).
(2) Electrical section.
(3) Signal section.

Following these general statements there was listed the accredited members of the divisions assigned to service on the American Engineering Standards Committee; the projects of the committee having official status in which the A. R. A. and A. R. E. A. have accredited representation co-operating officially in the sectional committee work; and the members of A. R. E. A. standing committees serving as members of A. E. S. C. sectional committees and on committees of co-operating societies.

Thoughts on Standardization

The American Engineering Standards Committee has been studying for some time two very important changes, (1) a revision of the constitution with the object of strengthening the hands of the organization in order to speed up the machinery, and (2) membership in a central body of co-ordinated groups in control of international standardization.

Since the first question was opened, there has developed quite a movement for making the committee a real national standardizing body, rather than a co-ordinating committee as it is now. In view of this, the chairman of this committee of the A. R. E. A., who is the official representative of the A. R. E. A. on the American Engineering Standards Committee, was invited by a member of the Constitution Revision Committee to express his views, which he did after careful consideration. In view of the information contained therein, and the general review of the work of standardization incorporated in this letter, it was made a part of the committee's report. Abstracts from the letter are contained in the following:

The active energetic and working forces for standardization anywhere are:

(a) The numerous trade associations, each of its own kind, a good representative being the Society of Automotive Engineers.

(b) The technical societies, managed and dominated by the users of materials, appliances and manufactured articles of all kinds, such as Division IV—Engineering, and Division V—Mechanical, of the American Railway Association.

(c) The technical societies, combining the interests of both (a) and (b), best represented by the American Society for Testing Materials.

The cross-currents of interest between all of these dif-

ferent organizations have become more numerous, crooked and diverse, so that the next step is to bring the many groups into a harmonious and instructive relationship with each other.

A perusal of the list of the various federal agencies found in the Standards Year Book will show that all of these groups can never be brought together, as the interests of many of them are so utterly different from the others that there is no relationship between them. There will thus be several different organizations in a country of national scope whose object will be to co-ordinate the various working agencies in which they are severally interested. It is my understanding the American Engineering Standards Committee was organized to act in that capacity for technical engineering bodies. It should, therefore, have a definite engineering field and not attempt to spread over all the interests in which it is not materially interested.

It seems to me, therefore, that the first course of procedure is to have in view a fairly well fixed scope of activity for the A. E. S. C. For the above reason I am opposed to the proposed new name American Standards Association, as it is entirely too unrestrictive and does not appear to me to indicate on its face the real work of the A. E. S. C. I believed the word "Engineering" belongs in the name.

It is evident from what has already been said that there are other organizations besides that of the A. E. S. C. claiming work of national scope and which are not affiliated with the A. E. S. C. It seems to me, therefore, that the A. E. S. C. is already formed on the correct basis of being a co-ordinating body only and can never become in itself a maker of standards. That work will always be done by the active agencies referred to in No. 1, and some of those standards, being of limited application, never will be referred to the A. E. S. C. It is only those of widespread use between inter-related associations and bodies which will or should be referred to the A. E. S. C. Examples of the kind mentioned are the cement specifications, the cross-tie specifications, etc.

We have not arrived at international relationship and it has not been made clear to me that this will be an advantageous relationship. We must know something of the influence and working of the International Electrotechnical Commission in foreign countries in relationship to other engineering standardizing bodies before that point can be settled. After that has been settled then it will be time enough to proceed with the details of union.

The report concluded with a statement of the work done at the Seventh International Conference on Weights and Measures at Paris last September.

Discussion

[In the absence of the committee chairman, W. C. Cushing (Penna.) the report of the committee was presented by C. R. Knowles (I. C.), who took the opportunity offered, to pay tribute to Mr. Cushing, and then outlined the work of the committee during the year.]

Mr. Knowles: With your permission I want to take this opportunity of saying a few words in recognition of Mr. Cushing's long and valuable service to the association. Mr. Cushing is a charter member and is now the sixth member on our rolls. He was a director from 1906 to 1908 and was president in 1911. He has been a member of the Rail committee since 1908 and served as chairman of that committee in 1913. He has also been a member of the Special Committee on Stresses in Track from 1912 to date, and chairman of the Standardization committee since 1926.

In addition to this he has contributed a larger number of monographs of outstanding value to the association than any other member. Mr. Cushing is not only one of the founders of the association but has continued to take a very active part in its work throughout the 28 years of its existence, and the growth and success of the association has been due in no small part to his untiring devotion to the work. The wisdom of Mr. Cushing's selection as chairman of this committee is evidenced by the results that have been obtained under his leadership.

A survey of the use of A. R. E. A. recommended practices by member roads indicates that they are widely used. For example, the report shows that probably 70 per cent of the standard plans, specifications and practices on the Missouri Pacific are either A. R. E. A. or closely related thereto.

American Railway Engineers Working Under Fire in France 10 Years Ago

Information furnished by 47 roads to the Committee on Ballast indicates the use of their recommended practice on a number of roads. As an example of the favorable attitude toward its work, the ballast section for gravel is used on 16 roads, the ballast section for stone is used on 12 roads, specifications for stone ballast on 17 roads, specifications for washed gravel on 16 roads, and ballast tests on 14 roads.

Perhaps the recommended practices most widely used are those of the Rail committee. A total of 23 roads are represented on this committee, and the report goes to considerable detail to show the extent of the use of the recommended practices on various railroads. It further indicates that while the recommended practices may not be used in detail, they are used as a basis and a general guide for determination of practice wherever conditions permit it.

[Following presentation of the report, *a motion for its acceptance was passed without discussion,* and the committee was excused.]

Report of the Committee on Ballast

PAUL HAMILTON (C.C.C.& St. L.)
Chairman
L. L. ADAMS (L.& N.)
J. S. BASSETT (M.P.)
G. J. BELL (A.T.& S.F.)
C. J. COON (N.Y.C.)
W. O. CUDWORTH (C.P.R.)
C. E. DARE (R.F.& P.)
F. T. DARROW (C.B.& Q.)
C. T. DIKE (C.& N.W.)
R. C. DUNLAY (M-K-T)
J. A. ELLIS (C.N.R.)
A. B. HILLMAN (Belt. Ry.of C.)
DANIEL HUBBARD (C.& O.)

Paul Hamilton

E. I. ROGERS (P.& P.U.)
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A. R. JONES (N.Y.C.)
A. A. JOHNSON (D.L.& W.)
W. J. H. MANNING (D.& H.)
E. F. MANSON (C.R.I.& P.)
J. F. MONTGOMERY (St.L.S.W.)
P. T. ROBINSON (S.P.)
W. A. RODERICK (W.& L.E.)
N. H. SELF (Sou.)
H. F. SHARPLEY (C.of Ga.)
C. B. STANTON (Carnegie Inst.)
A. H. WOERNER (B. & O.)

THE COMMITTE presented reports covering the following subjects:

(1) Revision of the Manual (Appendix A).

(2) Make a critical review of the material now appearing in the literature of the Association relating to ballast; ascertain existing views and practices of the railways; and recommend such changes as are found desirable (Appendix B).

(3) Investigate the comparative values of various ballast materials with special reference to drainage and effect on costs for track maintenance, collaborating Committee I—Roadway (Appendix C).

(4) Make a critical study of the cause and effect of pumping joints in railway track and the excess cost of maintenance resulting therefrom, with suitable recommendations for the removal of the cause, collaborating with Committee I—Roadway, and Committee V—Track (Appendix D).

(5) Investigate and report upon the shrinkage of ballast materials (Appendix E).

The committee recommended that the changes in the Manual, Appendix A, be approved; that the subject matter in Appendices B and D be received as information; and that Appendices C and E be received as progress reports and the subjects continued.

Appendix A—Revision of Manual

Collaborating with Committee XII—Rules and Organization, it was found that the matter on pages 83 to 86 inclusive of the Manual under the caption "Instructions to Govern Ballasting on an Operated Line," should be properly included in the rules to govern conduct of work. It was agreed that the Committee on Rules and Organization will submit to the Association for approval rules to govern the conduct of ballasting operations, and it was recommended therefore, that the matter appearing on pages 83 to 86, inclusive, be eliminated from the Manual upon the adoption by the Association of rules covering this subject presented by Committee XII.

Appendix B—Review of the Material on Ballast in Association Literature; Ascertain Practices of the Railways; and Recommend Changes

The committee sent out a questionnaire and 47 replies thereto have been received. The following tables are a digest of the replies made by the several railroads:

Sections

Type of Ballast	Number of roads using A.R.E.A. Standard	A.R.E.A. Modified	Their own Section	No answer to question	Type not used
Gravel	8	8	26	1	4
Stone	6	6	25	3	7
Other	4	2	25	4	12

Specifications

Type of Ballast	Number of roads using A.R.E.A. Standard	A.R.E.A. Modified	Their own Section	No answer to question	Type not used
Gravel	9	6	23	4	4
Stone	11	6	20	3	7
Other	4	2	25	12	4

Tests

Number of roads using recommended tests	11
Number of roads using some of the recommended tests	3
Number of roads not using recommended tests	27
Number of roads making no answer	6

Although few railroads indicated that they had adopted either the recommended sections or specifications the thought was expressed by nearly all that the Association's sections and specifications furnished data on which to base the sections or specifications used by the individual road. The commit-

tee, therefore, recommended that no changes in the sections or specifications be made at this time.

Appendix C—Comparative Values of Various Ballast Materials

This subject was studied in collaboration with representatives of Committee I—Roadway, and a questionnaire was sent out to 43 roads in the United States. Answers were received from 21 of these roads. In making a study of the figures received, and of conditions on different roads, considerable variation is found, due to different physical characteristics and density of traffic. The economical use of the various kinds of ballast is dependent almost entirely on these factors.

Where traffic is heavy and subgrade conditions are such that frequent surfacing is not necessary, stone ballast is more economical to use. However, where subgrade conditions are not good and a frequent movement occurs, caused by physical conditions, making necessary frequent working of the track, gravel ballast, which can be worked approximately fifty per cent cheaper and quicker, is much more economical.

There is some diversity of opinion as to the economical advantage obtained in the use of stone ballast on heavy coal carrying roads, due to the rapid filling up of voids by small particles of coal and coal dust. This, of course, will occur within a certain distance of the mines, say 150 miles. This necessitates much more frequent cleaning and the resulting loss of ballast.

Appendix D—Pumping Joints and the Excess cost of Maintenance Resulting Therefrom

The general causes of pumping joints can be listed almost entirely under the five following heads: (1) Water impounding in roadbed; (2) Foul ballast; (3) Creeping rail; (4) Light rail under heavy traffic; and (5) Improper or insufficient tamping.

The effect of this condition is as follows: (1) Bad riding track; (2) Excessive labor maintenance cost; (3) Excessive damage to ties, rail, and track fastenings; and (4) Unsightly appearance.

The remedies for these condtions in most cases have to be handled individually. However, there are certain general remedies that can be applied. Where it is necessary to drain water pockets in a roadbed, tiling or some form of pipe drain is considered best, due to "French drains" choking up more quickly than pipe, but each location must be studied separately, to determine the most economical arrangement. The roadbed and the track structure on top of it, including the ballast, should be constructed so that the maximum pressure per square foot will not be greater than that which the roadbed would stand.

With grading properly done in accordance with roadway specifications; ballast depth designed to meet conditions of roadbed and load; and drainage properly provided for, there should be no water pockets.

One road in particular has done considerable work in stabilizing the roadbed by putting in French drains or tile to cure the trouble. It has in the last few years also done considerable work in stabilizing the roadbed in shallow wet cuts where track was badly affected by water pockets, by driving piling about three feet to six feet beyond the ends of ties on each side of the track through soft spots. This piling seems to do two things; first, stabilizes the track by acting as a retaining wall on each side of the roadbed, and also breaks up the underlying stratum so that some underground drainage is afforded. This method should never be used unless there is an underlying stratum that will act as a sub-drainage.

Churning track and pumping joints should not be confused with what is commonly known as soft track, where the roadbed has broken down and water pockets have formed under the track. When cut open soft track shows the presence of water, even in driest weather. The ballast in these pockets is usually found loose, as contrasted with the hard packed ballast where the churning occurs.

Where the ballast has become fouled, the water will not drain and pumping joints will invariably be the result, in which case it is necessary to clean out all of the foul ballast, and either clean or replace with new, and give the track a substantial raise on the clean ballast. Local conditions will have to determine as to whether the expense of cleaning the ballast is justified. In most cases where the ballast is sufficiently fouled to cause a large number of pumping joints, the expense of cleaning will be justified, as we have developed that it costs two and one-half to four times as much to maintain track where the joints are pumping badly as where the track is well drained and no signs of pumping occur.

Where track is not properly anchored and the joints are slot-spiked to the joint ties, the creeping of the rail will move the joint ties off of their beds, and this condition will always aggravate and sometimes causes the joints to pump. If, in addition, the bolts in the joints are loose or worn, the bad condition will be increased. In order to check this move ment of the rail, anchors should be applied.

Where the ends of the rail have become chipped or battered pumping joints are nearly always found. A certain road had twenty miles of track laid with badly battered one-hundred-pound rail a year ago. Nearly all of the joints in this stretch of track were pumping badly, but were almost entirely cured by building up the rail ends by a welding process, and the labor cost of maintaining this stretch of track before building up was done was about two and one-half times as much as it has been since the work was completed.

Where a light rail is used under heavy loads, the pressure on the ballast and roadbed is not distributed as it is where heavy rail is used, and pumping joints are much more likely to develop than where the rail is of sufficient weight.

Improper or insufficient tamping is a very direct cause of pumping joints. It is believed that with proper tamping of joints, one of the major causes of pumping joints will be eliminated.

Appendix E—Shrinkage of Ballast

Ballast, other than pit run gravel, cannot be measured in place at the point of origin, so the usual practice is to measure the loosely loaded ballast on cars or by weighing. The majority of railroads in handling their ballast, while they may buy it by weight, usually convert it into cubic yards and report it as used and paid for on that basis. It is the belief of many that there is no actual shrinkage or loss of ballast between the point of origin and destination if loaded in proper equipment, admitting, however, that there is a loss in the volume, due to the settlement of the ballast in the cars.

Two tests, one with gravel ballast and one with

broken stone, have come to our attention, and in the case of the washed river gravel, it was found that after transporting same 152 miles, there was a loss of 13.79 per cent in volume, and in the case of the crushed limestone, while there was a loss in the four cars tested of only 190 lb., there was a loss in volume of 13 per cent. These two tests show that there is a volumetric shrinkage due to hauling the ballast, and bring out the fact that considerable care should be exercised as to the determination of the average weight of the cubic yard of ballast which is to be later applied to the aggregate weight of ballast used or purchased. No injustice will be done either the railroad or the contractor if it is definitely settled where and when measurements are to be taken, for the price will be adjusted to meet the requirements.

The committee is attempting to determine the shrinkage of ballast by comparing the yardage loaded loosely in cars at the point of origin, where it is paid for, with the yardage of the same material tamped and compacted in track under the passage of trains. It is of the opinion that this can only be determined by prolonged tests being conducted on either old solidified roadbeds or on concrete trestles. It is hoped that this work can be done the coming year through the co-operation of those roads particularly which will construct new concrete trestles.

Attention was called to the subject, "Shrinkage of Ballast," as it appears on page 84, Volume 27, No. 277, Supplement to the Manual of 1921, as same has been set forth by H. E. Hale, Vice-Chairman of the Eastern Group of the Presidents' Conference Committee. The committee did not make any recommendations as to the data therein, but is of the belief that it is very valuable, and called particular attention to the following paragraph:

> "The difficulty of measuring with reasonable accuracy the shrinkage of ballast is due to the usual practice of ballasting a road piecemeal and to the general practice of keeping no record of the location of ballast bought under various contracts from various pits."

The committee has found this difficulty to exist, and it is our belief that it can only be overcome by the committee itself being present when the ballast is weighed or measured, loaded, placed and tamped under the track.

Discussion

[The work of the committe was outlined by Chairman Paul Hamilton (C. C. C. & St. L.) and by subcommittee chairmen L. L. Adams (L. & N.) and E. I. Rogers (P. & P. U.) who briefly reviewed their respective reports which were then accepted without further discussion and the committee excused with thanks.]

Report on Shops and Locomotive Terminals

F. E. Morrow (C.& W.I.)
Chairman

A. L. Atwill (C.& W.I.)
C. N. Bainbridge (C.M.St.P.& P.)
Leland Clapper (D.& I.R.)
N. Corey (I-G.N.)
J. H. Davison (M.& I.)
K. B. Duncan (G.C.& S.F.)
E. A. Dougherty (N.Y.C.)
R. J. Hammond (B.& M.)
Geo. W. Hand (C.& N.W.)
C. D. Harding (G.T.W.)
C. E. Harris (D.P.Robinson)
G. W. Harris (A.T.& S.F.)
J. L. Haugh (U.P.)
Daniel Hillman (C.P.R.)
C. A. Hornecker (M.P.)

F. E. Morrow

A. T. Hawk (C.R.I.&P.)
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L. P. Kimball (B.& O.)
W. H. Kirkbride (S.P.)
W. T. Krausch (C.B.& Q.)
H. C. Lorenz (C.C.C.& St.L.)
J. S. McBride (C.& E.I.)
J. M. Metcalf (M-K-T.)
D. A. Porter (S.P.)
V. B. W. Poulsen (C.& O.)
W. A. Radspinner (C.& O.)
J. W. Raitt (N.& W.)
John Schofield (C.N.R.)
L. K. Sillcox (N.Y.Air Brake)
B. S. Voorhees (N.Y.C.)
H. W. Williams (C.M.St.P.& P.)

THE COMMITTEE presented reports on two subjects: locomotive coaling stations (Appendix A); and methods for the safe and convenient storage of crude and fuel oil and oil reclaiming sumps (Appendix B). It recommended that the conclusions and typical specifications for mechanical type coaling stations in Appendix A be approved for publication in the Manual, and that the report in Appendix B be received as information.

Appendix A—Locomotive Coaling Stations

A mechanical coaling station should be understood as one consisting of an unloading hopper and some form of mechanically operated conveying machinery for elevating the coal and delivering it to locomotive tenders, either directly or through storage bins.

Recognizing the well-established practice of a majority of the railways to purchase coaling stations completely installed, it was the purpose of this report to outline the requirements for such projects and develop a typical specification, which, when amplified to fill the requirements of a particular installation, serve as a basis for securing competitive proposals that are on a comparative scale, and which are also a guide for the checking of detailed working drawings which are prepared by the successful contractor after the award of a contract.

Location—The location of a coaling station should be selected with a view to serving the best interests from an operating standpoint. At terminals coaling stations should be located so as to serve both inbound and outbound tracks.

Track Layout—The mechanical coaling station can readily be arranged to deliver coal on one, two, three, four or even more tracks. A number of combinations which can be used, and which will provide suitable clearances and space for elevating equipment, are shown below.

Hopper and Unloading Track—Except in cases where coal is delivered direct to locomotives without the use of

a storage bin, the unloading hopper should be at least 20 ft. in length and in larger installations it is desirable to use a greater length to secure additional storage before elevation and to avoid the necessity of accurate spotting of cars. In some very small plants where hopper bottom cars are used a less length of hopper may be justified to save construction cost. In some larger installations it may be desirable to use two unloading hoppers, in which case they should be on separate tracks. The unloading track or tracks should have a capacity both for loaded and for empty cars equivalent to the capacity of the storage bins.

Car Haul—It is usually desirable and convenient for use in spotting of cars over the track hopper to have a mechanically operated car puller either as a separate unit or in conjunction with the hoisting equipment, and specifications should state definitely just what is required.

Storage Bins—The bins should have a total capacity at least equal to the consumption in 36 hours, and separate bins should be provided for different grades of coal where required. Except in cases of very small storage capacity it is good practice to divide the storage space into two bins even where different grades of coal are not handled. This will permit the cleaning or repair of a bin without affecting the operation of the coaling station seriously, and will also be desirable in the event of any future requirements for more than one grade of coal. Storage of coal in unused pockets should be prevented on account of fire hazards.

Hoisting Capacity—The hoisting capacity of the elevating machinery should be such as to permit the elevation of an entire 24 hours consumption during one 8 hour shift. In large and important stations it may be desirable to divide the hoisting capacity into two units to guard against breakdowns.

Power—Where available electricity should be adopted and the particular characteristics of the current to be used should be given. At locations where electricity cannot be secured, steam or internal combustion engines may be used and the particular one desired should be specified together with the requirements for the handling and storage of fuel.

Material of Construction—Coaling stations may be constructed of wood, steel or concrete materials, but in any case the particular materials selected should be specified.

Crushers and Breaker Bars—Where coal in proper sizes cannot be obtained from mines, or when it is not economical to do so, provision should be made for crushers or breaker bars. Specifications should state the type and capacity of crusher required, and whether it is desired to locate it in the hopper or over the bins. A location in the hopper is generally preferred as this eliminates the necessity of carrying a heavy load with considerable vibration high up in the structure but it usually involves the use of an additional horizontal conveyor unit to avoid an abnormally deep pit.

Scales—Where a record must be kept of the amount of coal delivered to each locomotive, scales should be provided for that purpose. This can best be accomplished by the use of a small weigh hopper supported on scale levers over each delivery spout. The capacity of hopper should be slightly greater than the largest amount issued to a locomotive at one time.

Interior Chutes—Where conditions make it desirable to prevent, as far as possible, the breaking up of lump coal and the separation of lump and slack, provision should be made in the specifications for the installation of special chutes or other means of preventing long drops when discharged from the conveyor into storage bins.

Housing—The shaft for elevating equipment may be housed or not. Specifications should state definitely whether or not housing is required. If required, the materials to be used should be fully described. It is usually the practice to provide a housing over the unloading hopper if it is not protected by the structure of the bins. Specifications should state whether such a housing is required and if desired, the materials to be used should be described.

Sanding Facilities—When sanding facilities are combined with a coaling station project the specifications should provide for the requirement of unloading, storing and drying of green sand and for the elevating, storing and delivery of dry sand to locomotives.

Electrical Work—Electric wiring for light and power service is usually handled by the railroad's own organization or on separate contract. Specifications should state definitely, however, as to this feature. In the event that this is to be included in the contract the specifications should describe in detail the extent and character of the work required.

Typical Specifications for Coaling Stations—Mechanical Type

General—These specifications are intended to cover the special features which will be required in connection with the design and construction of coaling stations. They shall be used with special specifications prepared for a particular installation, and also with the specifications of the American Railway Engineering Association for buildings, masonry, iron and steel structures and wooden bridges and trestles for items of structural design, character of materials and execution of work in so far as they apply.

Type of Construction—Storage bins and supports, hoist tower, and machinery house shall be constructed of timber, structural steel, or concrete, or a combination of them, as may be indicated in special specifications for particular installation. Foundations and hopper pit shall be of concrete construction, and in the event any all steel or concrete superstructure is specified no wood of any kind will be permitted in the finished structure.

Description of Plant—The plant shall consist of an unloading hopper or hoppers, mechanically operated conveying equipment for elevating coal, and bins for storing same and delivering to locomotives by gravity. The design of the plant shall be such that its operation is entirely automatic until it is desired to stop the operation.

Design—Unit stresses used in design shall be in accordance with American Railway Engineering Association requirements as previously specified. As a basis for the proposal unless otherwise specified an allowable soil bearing pressure of 3,000 lb. per sq. ft. shall be used. All foundations shall be carried at least four feet below base of rail of adjacent tracks. Wind load shall be assumed at 30 lb. per sq. ft. acting horizontally in any direction.

Track Arrangement—The required arrangement of the hopper track and coaling tracks for which the plant must be designed is shown on location plan accompanying these specifications.

Storage Bins—Storage bins of the number and capacity required by the special specifications shall be provided and the capacity specified must be obtained without any trimming or handling of coal in bins. The sloping surfaces of bins shall be at least 45 deg. and all valleys and ridges shall be rounded to a radius of at least 18 in.

In steel superstructures the side plates of storage bins shall have a minimum thickness of ¼ in. and bottom plates ⅜ in. In wood superstructures the floor shall be lined with 3/16 in. steel plates, and the side walls for full height of the bin with No. 10 gage steel plates. Steel plate lining shall be securely fastened in place with countersunk flat head screws and shall be accurately fitted to the slope of the bin and gates and shall be properly curved at valleys and ridges.

Clearances—The design shall be such that when the delivery chutes are raised all parts of the structures shall have clearances to tracks at least the equivalent of those adopted by the Association in the General Specifications for Steel Railway Bridges, unless otherwise prescribed or required by any law.

Unloading Hopper—The unloading hopper shall be of concrete construction 16 ft. wide and at least 20 ft. long in the clear. The slopes shall be at least 10 in. vertical in 12 in. horizontal and all valleys shall be rounded to a radius of at least 18 in. The lines of intersection of the side walls of the pit with the sloping floor shall be such that there will be at least 18 in. clearance below the bottom of any track beam or breaker bars to the surface of the hopper. The unloading track shall be carried over the hopper on a structural steel beam under each rail, preferably spanning the entire length of the hopper. If an intermediate support is necessary a steel cross girder rather than a masonry pier shall be used. Rails will be installed by the railroad company. The level of the unloading track at the unloading hopper shall, unless otherwise specified, be at least two feet above that of the coaling tracks. The contractor shall waterproof the hopper and the hoist pit and shall guarantee this waterproofing for a period of at least one year.

Collision Walls—Framework supporting storage bins, where adjacent to coaling tracks, shall be protected by means of a concrete collision wall extending the full length of the structure and to a point 4 ft. beyond the center line of the supporting column at each end, at least 2 ft. thick and extending to a height of 6 ft. above the top of rail of coaling tracks. Openings shall be provided in these collision walls as required to permit the convenient salvaging of coal wasted off of tenders. These walls must have clearances as hereinbefore specified.

Screening and Separation—The station shall be provided with bar screen over bins, bars to be spaced about two inches apart to permit the separation of lumps and screenings in run-of-mine coal and shall further be provided with chutes and gates which will permit the delivery of any grade of coal to any bin.

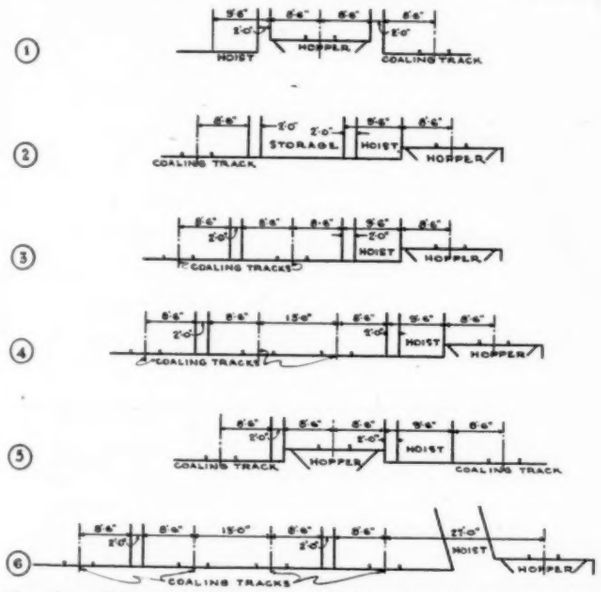
Operating mechanism shall be placed in a convenient location at the track level.

Ladders, Stairways, etc.—The contractor shall provide ladders on the outside of the structure with the necessary platforms and railings to enable the operator to reach each gate, outside sheave, sand spout and sand pipe turn for repairing, oiling, or any other purpose. He shall also provide ladders on the inside of the bins so that the operator may be able to reach the bottom of each bin at each gate. He shall also provide a suitable stairway located where most convenient and extending from the track level to the top of the hoist tower. All stairways, platforms and landings, either inside or outside of the structure shall be provided with suitable railings and approved open grating treads. Open grating walkways two feet wide shall be provided on each side of the unloading hopper, of an approved type.

Windows and Doors—The contractor shall install the necessary doors to provide access to structure and such pivoted steel windows as are necessary to afford ample light in all parts of the plant. For the concrete and steel superstructure all windows and doors shall be of metal construction and glazed with wire glass.

Coaling Fixtures—The contractor shall install, for the delivery of coal from each storage bin to each coaling track, a steel chute and gate of approved design. Each chute shall be equipped with an apron and baffle plate arranged so that fall of coal after leaving chute will be vertical and over center line of coaling track.

Chutes and gates shall be counterweighted and designed and installed in such a way as to permit of same being operated



Sketches Showing Relation of Coaling Station to Tracks

adjusted that gate and chute will close and return to normal position when released by the operator. All outside parts of mechanism shall be hooded or otherwise protected against freezing. Hand holes shall be provided in the side of the chute between each gate and bin wall. Chutes, when in the low position, shall be not less than 15 ft. 6 in. above top of rail. by one man when standing on top of locomotive tender or on overhead platform if provided. Counterweights shall be so

Power—The power to be used for operation of equipment shall be as provided in special specifications.

Hoisting Equipment—The hoisting equipment, which shall be furnished and installed by the contractor, shall be entirely capable of hoisting the quantity of coal per hour as required by special specifications, without undue crowding, overloading or forcing. The hoist and power units shall be placed upon suitable concrete foundations and shall be placed at such an elevation as to allow ample clearance for gears, fly wheels and belting. All gearing and exposed parts and belting shall be protected in an approved manner by means of neat and substantial guards or railings so that operator will not be exposed to any danger from moving machinery. All machinery and other equipment shall be assembled and installed in a thorough and workmanlike manner. The transmission equipment and cables between hoist and hoisting tower shall be securely housed to provide adequate protection from weather.

Electrical Equipment—Electrical equipment and wiring shall be designed to operate with current of the kind and voltage stated in special specifications. Electric service will be brought to the machinery house and connected to a main service switch by the railroad. Installation of motor, control and all other necessary wiring and accessories to make a complete and satisfactory installation shall be furnished and installed by the contractor. All work must conform to the requirements of the National Board of Fire Underwriters, local municipal building codes and any special regulations of the lighting service company that may be in effect. Motors shall have proper speed and torque characteristics for the service for which they will be used. They shall have anti-friction bearings and insulation suitably impregnated to withstand moisture, coal dust, etc. Control shall be of the magnetic type with all necessary accessories for proper operation of the equipment, equipped with undervoltage protection, overload protection of the temperature overload relay type, necessary push button stations, limit switches, etc.

Plans to be Furnished by the Contractor—The successful contractor shall prepare complete detail drawings of all parts of the structure and equipment. These plans shall be submitted in triplicate to the engineer for approval. He shall also furnish, in triplicate, a complete list of all parts of machinery with pattern numbers or other designation to permit the ready ordering of repair parts.

Guarantee—The contractor will be held solely responsible for the design of the coaling station and equipment in accordance with these specifications, and the checking and approval of plans by the engineer will not relieve him of this responsibility.

Appendix B—Methods for the Safe and Convenient Storage of Crude and Fuel Oils

The most common method of large storage of crude and fuel oils, as well as the lighter petroleum products, is in steel tanks. Tanks of 37,500, 55,000 and 80,000 barrels capacity are standard sizes with the manufacturers and are in general use both by the oil companies and by the fuel oil using railways.

The danger of fire loss in stored oil varies with the character of the oils. The more volatile refined oils and some crude oils having an unstable mixture of the lighter elements are not only more readily inflammable but present a greater hazard when stored in other than gas-tight receptacles, on account of the presence on the surface and in the vicinity of the tank of inflammable gases resulting from evaporation. For such oils the all-steel tank with floating or other gas-tight roof affords the best protection against lightning or other fire risk. The increasing use of such tanks by oil companies and others is evidence of the belief that the greater cost is justified by the added protection and reduction in loss by evaporation. Some western railroads using more readily inflammable oil report the extensive use of floating roofs of various designs, the most recent installations being of the "pontoon" or non-sinkable type.

The residuum fuel oils in common use as locomotive fuel by the railways contain little volatile matter and offer comparatively little risk of loss by fire. Replies to questionnaire indicate that the railroads generally, which are using oil of this character, are installing no special devices for lightning protection and have had, over a series of years, practically no loss by fire. More than one case is reported in which a tank with tar and gravel roof on wood frame has been struck by lightning without causing a serious fire.

A common method of fire protection is the introduction at two or more places near the top of a tank of small pipe outlets, two inches or so in diameter, through which live steam may be discharged in case of fire, over the surface of the oil, for the purpose of smothering the flames. Chemical extinguisher and engine of the smothering type are also desirable and effective and should be on hand at convenient locations wherever oil is stored or delivered.

Oil Reclaiming Sumps—The use of sumps for reclaiming fuel oil from waste and runoff water around

storage tanks and locomotive terminals is in general recommended only where required to prevent damage to adjoining property. Where the discharge into open drainage channels of waste water containing oil causes complaint, some means of separating the oil from the water and removing it before the water is turned loose becomes a necessity.

Sumps for separating oil from water operate by gravity, the lighter oil naturally rising to the surface when the water is allowed to settle, and then drawn off from the bottom. A box with a series of baffles open at the bottom for the passage of the water is a common form, the oil being skimmed off at the top. The capacity required depends largely upon local conditions. For the ordinary case the simple form of baffled box may be sufficient.

A more elaborate design, used by the Santa Fe at Prescott, was to meet a situation where use of water for irrigation purposes made necessary more complete separation. For such conditions, a formula is suggested for determining capacity which provides 10 sq. ft. of top area and 25 cu. ft. of volume for each engine handled per month.

Discussion

[The report was presented by Chairman F. E. Morrow (C. & W. I.). He introduced L. P. Kimball (B. & O.) and J. M. Metcalf (M-K-T), sub-committee chairman, who submitted Appendices A and B as information. These were received without comment and the committee was dismissed with the thanks of the association.]

Report on Iron and Steel Structures

B. R. Leffler (N.Y.C.)
Chairman
P. S. Baker (Reading)
J. E. Bernhardt (C.& E.I.)
A. W. Carpenter (N.Y.C.)
O. F. Dalstrom (C.& N.W.)
R. P. Davis (U.& W.Va.)
F. O. Dufour (Laf.Col.)
Thos. Earle (Beth.Steel)
G. H. Gilbert (Sou.)
G. A. Haggander (C.B.& Q.)
C. S. Heritage (K.S.C.)
O. E. Hovey (Am.Bridge)
J. B. Hunley (C.C.C.& St.L.)
P. G. Lang, Jr. (B.& O.)
W. S. Lacher (Ry.Age)
Crosby Miller (C.& O.)
P. B. Motley (C.P.R.)
Albert Reichmann (Am.Bridge)

B. R. Leffler

A. R. Wilson (Penna.)
Vice-Chairman
A. F. Robinson (A.T.& S.F.)
H. N. Rodenbaugh (F.E.C.)
O. E. Selby (C.C.C.& St.L.)
I. L. Simmons (C.R.I.& P.)
P. B. Spencer (N.Y.,N.H.& H.)
S. M. Smith (Wabash)
R. O. Stewart (C.N.R.)
H. B. Stuart (C.N.R.)
R. M. Stubbs (M-K-T)
G. H. Tinker (N.C.& S.L.)
G. H. Trout (U.P.)
F. E. Turneaure (U.of Wis.)
F. P. Turner (N.& W.)
H. T. Welty (N.Y.C.)
W. L. Wilson (Lehigh U.)
W. M. Wilson (U.of Ill.)

THE COMMITTEE'S report dealt mainly with Subject No. 9, Punched and Reamed Work, Appendix A, which it recommended be received as information. It also reported progress on Subject 1, Revision of the Manual; Subject 2, Specifications for Highway Bridges; Subject 5, Column Tests; Subject 6, Investigation of Copper-Bearing Steel for Structural Purposes; and Subject 10, Investigation of Bearing Pressures on Large Rollers.

On Subject No. 1, Revision of Manual, it reported that investigations and tests on a number of subjects are under way, including bearing values of large rollers, testing of I-beams in groups, investigation of copper-bearing steel for structural purposes, and tests on columns.

On Subject No. 2, Specifications for Steel Highway Bridges, it reported that the sub-committee has been in conference with the American Association of State Highway Engineers in drafting a specification for highway bridges. The subject-matter is complete and is in the hands of the editing committee, but cannot be presented to the convention this year.

On Subject No. 5, Column Tests, the committee is collaborating with the Column committee of the American Society of Civil Engineers, of which Dean Turneaure is chairman. Under the direction of Dean Turneaure, experiments are being made on columns loaded eccentrically. The purpose of these experiments is to determine the longitudinal shearing effect on columns and the necessary strength of lacing.

On Subject No. 6, Investigation of Copper-Bearing Steel for Structural Purposes, the committee reported that the use of copper-bearing steel for various industrial and structural purposes is increasing; it is now being used in the manufacture of steel cars, tie plates, track spikes, smoke stacks, stationary boilers, metal culvert pipes, metal flashings, ventilators, wire fencing, light structural steel for warehouses, steel sash, power line supports, flood light towers, and overhead electrification structures for railway tracks.

Copper-bearing steel in such service has, in many instances, been found to last twice as long as ordinary steel. It has been little used in railway bridge construction, but records show its use in several important highway bridges. Its application for structural purposes is widening, and its use is now extending to roof trusses in railway shop buildings that are exposed to marked corrosive influences. Copper-bearing steel can be readily secured at slight increase in cost.

On Subject No. 10, Investigation of Bearing Pressures on Large Rollers, the committee reported that the investigation has brought out much new and valuable information on the bearing values of rollers. Tests to determine the bearing value of large rollers have continued through the year at the Uni-

versity of Illinois. Rolling tests have been made on plates of medium grade steel castings varying in thickness from .5 in. to 4 in. when rolled by cylinders having diameters of 188 in., 356 in., and 476 in.

Appendix A—Punched and Reamed Work

The committee made the following recommendations: That Article XII, Workmanship, in General Specifications for Steel Railway Bridges, as issued August, 1925, Third Edition, be revised and their report be received as information. The proposed specifications are as follows:

General—206. The workmanship and finish shall be equal to the best general practice in modern bridge shops. Material at the shops shall be kept clean and protected from the weather as far as practicable.

Straightening Material—207. Rolled material, before being laid off or worked, must be straight. If staightening or flattening is necessary, it shall be done by methods that will not injure the material. Sharp kinks and bends may be cause for rejection.

Finish—208. Shearing and chipping shall be neatly and accurately done and all portions of the work exposed to view shall be neatly finished.

Punching and Reaming—209. All main material, forming parts of a member composed of not more than five thicknesses of metal, may be punched with a punch $\frac{1}{16}$ in. larger than the nominal size of the rivets, whenever the thickness of the metal is not greater than $\frac{5}{8}$ in. When there are more than five thicknesses, or when any of the main material is thicker than $\frac{5}{8}$ in., all of the holes shall be punched with a punch $\frac{1}{16}$ in. smaller, and after assembling reamed $\frac{1}{16}$ in. larger than the nominal size of the rivets, except that when the metal is thicker than the size of the rivet minus $\frac{1}{8}$ in., the holes shall be drilled.

210. Holes in material $\frac{7}{8}$ in. or less, used for lateral, longitudinal and sway bracing, lacing, stay plates and diaphragms, may be punched with a punch $\frac{1}{16}$ in. larger than the nominal size of the rivet.

211. The diameter of the die shall not exceed the diameter of the punch by more than $\frac{1}{16}$ in. If any holes must be enlarged to admit the rivets, they shall be reamed. Holes must be clean cut, without torn or ragged edges. Poor matching of holes may be cause for rejection.

Reaming After Assembling—212. Reaming shall be done after the pieces forming a built member are assembled and so firmly bolted together that the surfaces are in close contact. Burrs on the outside surface shall be removed. The pieces shall be taken apart before riveting, if necessary, and any shavings removed. When it is necessary to take the members apart for shipping or handling, the pieces reamed together shall be so marked that they may be reassembled in the same position in the final setting up. No interchange of reamed parts will be permitted.

213. The holes shall be cylindrical, perpendicular to the member, and not more than $\frac{1}{16}$ in. larger than the nominal diameter of the rivets. Reamers preferably shall not be directed by hand.

Drilled Holes—214. Drilled holes shall be $\frac{1}{16}$ in. larger than the nominal size of the rivet. Burrs on the outside surfaces shall be removed. Drilling shall be accurately done and poor matching of holes may be cause for rejection.

Reaming and Drilling—215. Reaming and drilling shall be done with twist drills.

Shop Assembling—216. The parts of riveted members shall be well pinned and firmly drawn together with bolts before riveting is commenced. The drifting done during assembling shall be only such as to bring the parts into position and not sufficient to enlarge the holes or distort the metal.

Field Connections—217. Solid floor sections shall be assembled to the girders or trusses, or to suitable frames, in the shop, and the end connections made to fit.

218. Riveted trusses shall be assembled in the shop to line and fit and the holes for field connections drilled or reamed while so assembled, or these connections may be reamed to proper metal templates so placed as to result in fair holes for the connections. Holes for other field connections, except those in lateral, longitudinal and sway bracing, shall be reamed or drilled to a metal template.

Match-Marking—219. Connecting parts assembled in the shop for the purpose of reaming or drilling holes in field connections shall be match-marked, and a diagram showing such marks shall be furnished the Engineer.

Rivets—220. The size of rivets called for on the plans shall be the size of the rivet before heating.

221. Rivet heads shall be of approved shape and of uniform size for the same diameter of rivet. They shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member.

Riveting—222. Rivets shall be heated uniformly to a light cherry red and driven while hot. They shall be free from slag, scale, and carbon deposit. When driven, they shall completely fill the holes. Loose, burned, or otherwise defective rivets shall be replaced. In removing rivets, care shall be taken not to injure the adjacent metal and, if necessary, they shall be drilled out. Caulking or recupping will not be permitted.

223. Rivets shall be driven by direct-acting riveters where practicable. The riveters shall retain the pressure after the upsetting is completed.

224. When rivets are driven with a pneumatic riveting hammer, a pneumatic bucker shall be used for holding up, when practicable.

Field Rivets—225. Field rivets shall be furnished in excess of the nominal number required to the amount of 15 per cent, plus 10 rivets, for each size and length.

226. Field rivets shall be free from fins on the under side of the head.

Turned Bolts—227. Where turned bolts are used to transmit shear, the holes shall be reamed parallel and the bolts shall make a tight fit with the threads entirely outside of the holes. A washer not less than $\frac{1}{4}$ in. thick shall be used under each nut.

Planning Sheared Edges—228. Sheared edges of material more than $\frac{3}{4}$ in. thick and carrying calculated stress shall be planed to a depth of $\frac{1}{4}$ in. Reentrant cuts shall be filleted before cutting.

Lacing Bars—229. The ends of lacing bars shall be neatly rounded, unless otherwise called for.

Fit of Stiffeners—230. Stiffeners under the top flanges of deck girders and at all bearing points shall be milled or ground to bear against the flange angles. Other stiffeners must fit sufficiently tight against the flange angles to exclude water after being painted. Fillers and splice plates shall fit within $\frac{1}{4}$ in. at each end.

Web Plates—231. Web plates of girders which have no cover plates may be $\frac{1}{8}$ in. above or below the backs of the top flange angles. Web plates of girders which have cover plates may be $\frac{1}{2}$ in. less in width than the distance back to back of flange angles.

232. When web plates are spliced, not more than $\frac{3}{8}$ in. clearance between ends of plates will be allowed.

Facing Floor Beams, Stringers and Girders—233. Floor beams, stringers and girders having end connection angles shall be made of exact length. If facing is necessary, the thickness of the end connection angles shall not be reduced more than $\frac{1}{8}$ in. at any point.

Finished Members—234. Finished members shall be true to line and free from twists, bends and open joints.

Abutting Joints—235. Joints in compression members and girder flanges, and where so specified on the drawings, in tension members, shall have the abutting surfaces faced and brought to an even bearing. Where joints are not faced, the opening shall not exceed $\frac{1}{4}$ in.

Eye-Bars—236. Eye-bars shall be straight true to size, and free from twists, folds in the neck or head, and other defects. The heads shall be made by upsetting, and rolling or forging. Welding will not be allowed. The thickness of the head and neck shall not overrun more than $\frac{1}{16}$ in. for bars 8 in. or less in width, $\frac{1}{8}$ in. for bars more than 8 in. and not more than 12 in. in width, and $\frac{1}{16}$ in. for bars more than 12 in. in width.

237. Eye-bars which are to be placed side by side in the structure shall be bored so accurately that, upon being placed together, the pins will pass through the holes at both ends at the same time without driving. Eye-bars shall have both ends bored at the same time.

Annealing—238. Eye-bars shall be annealed by heating uniformly to the proper temperature followed by slow and uniform cooling. Proper instruments shall be provided for determining at all times the temperature of the bars.

239. Other steel which has been partially heated shall be annealed except where used in minor parts.

Boring Pin Holes—240. Pin holes shall be bored true to gage, smooth, straight at right angles with the axis of the member and parallel with each other, unless otherwise required. The variation from the specified distance from outside to outside of pin holes in tension members, or from

inside to inside of pin holes in compression members, shall not exceed $\frac{1}{32}$ in. for each 75 ft. or fraction thereof in length. In built-up members the boring shall be done after the member is riveted.

Boring Pins—241. Pins more than 9 in. in diameter shall have a hole bored horizontally through the center of each not less than 2 in. in diameter.

Pin Clearances—242. The difference in diameter between the pin and the pin hole shall be 1/50 in. for pins up to 5 in. in diameter, and $\frac{1}{32}$ in. for larger pins.

Pins and Rollers—243. Pins and rollers shall be accurately turned to gage and shall be straight, smooth and free from flaws.

Screw Threads—244. Screw threads shall make close fits in the nuts and shall be U. S. Standard, except that for pin ends of diameters greater than $1\frac{3}{8}$ in. they shall be made with six threads to an inch.

Forging Pins—245. Pins more than 7 in. in diameter shall be forged and annealed.

Bearing Surfaces Planed—246. The top and bottom surfaces of base and cap plates of columns and pedestals shall be planed, or hot-straightened, and parts of members in contact with them shall be faced to fit. Connection angles for base plates and cap plates shall be riveted to compression members before the members are faced.

247. Sole plates of plate girders shall have full contact with the girder flanges. Sole plates and masonry plates shall be planed or hot-straightened. Cast pedestals shall be planed on the surfaces in contact with steel and on surfaces resting on masonry.

Pilot Nuts—248. Two pilot nuts and two driving nuts shall be furnished for each size of pin, unless otherwise specified.

Discussion

[The report of the committee was presented by Chairman B. R. Leffler (N. Y. C.) who read the introduction to the report in full. His recommendations to the effect that the matter submitted under the various headings be received as information were approved. After reading the summary on Subject No. 2, Specifications for Steel Highway Bridges, he introduced O. E. Selby (C. C. C. & St. L.) who is one of the committee's representatives in the conference with the representativs of the American Association of State Highway Officials in the drafting of the new specifications, and Mr. Selby reviewed the work of the conference. He commended the spirit of fairness with which the work had been carried on and expressed his satisfaction with the specifications that have been agreed upon by the conference.

Mr. Leffler then stated that the committee had reviewed the specifications at its meeting in February and had endorsed the opinion expressed by Mr. Selby. He also pointed to the importance of having the specifications submitted to the association as information and owing to the lack of sufficient time to have it published before the meeting, he recommended that it be printed in the April bulletin. This was approved and the committee was dismissed with the thanks of the association.]

Report on Wooden Bridges and Trestles

W. E. Hawley (D.M.& N.)
Chairman
H. Austill (M.& O.)
F. E. Bates (M.P.)
E. H. Brown (N.P.)
Charles Chandler (J.G.Brill)
C. H. Chapin (C.& O.)
C. R. Chevalier (M.P.)
F. H. Cramer (C.B.& Q.)
W. J. Goodings (S.A.L.)
S. F. Grear (I.C.)
R. P. Hart (M.P.)
F. M. Hawthorne (Penna.)
C. S. Heritage (K.C.S.)
A. P. Himes (N.Y.C.& St.L.)
W. B. Hodge (C.C.C.& St. L.)
C. J. Hogue (W.C.Lumber Assn.)

W. E. Hawley

J. B. Maddock (C.of Ga.)
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C. T. Jackson (C.M.St.P.& P.)
M. B. Kent (I-G-N)
L. V. Lienhard (A.T.& S.F.)
R. E. Miller (St.L-S.F.)
J. A. Newlin (For.Prod.Lab.)
C. E. Paul (Armour Inst.)
G. W. Rear (S.P.)
Arthur Ridgway (D.& R.G.W.)
J. R. Sexton (H.H.Robertson)
D. W. Smith (H.V.)
M. A. Stainer (F.W.& D.C.)
G. C. Tuthill (M.C.)
J. L. Vogel (D.L.& W.)
Wm. Walkden (C.N.R.)

*Deceased

THE COMMITTEE reported as follows:

(1) Revision of the Manual (Appendix A);

(2) Simplifications of grading rules and classificaton of timber for railway uses, collaborating with the Committee on Rules and Organization, and other organizations dealing with this subject (Appendix B);

(3) Revision of present specifications for treated and untreated timber piling, collaborating with the Committee on Wood Preservation (Appendix C);

(4) Advantage of establishing supply yards for standard trestle timbers at various locations throughout the country (Appendix D);

(5) The standardization and simplification of store stock and disposition of material reaching obsolescence.

The committee recommended that the specifications for piles in Appendix C be adopted by the Association for printing in the Manual, and that the other reports be received as progress and the subjects continued. No changes were recommended in the Manual.

Appendix B—Simplification of Grading Rules and Classification of Timber for Railway Uses

The lumber standardization in the softwood industry from which standards were drawn and adopted by the A. R. E. A. last year has reached the point at which a look backward and another

year's trial might be made without further revision. This is a sign that real progress has been made and a fair degree of unanimity of opinion in the industry has been secured. Hence the committee has not found it necessary to report new revisions of these standards.

The emphasis has now passed from the formation of the standards to the securing of more general use of these standards by all users. It is here that the committee desires to ask that the railways of America shall give their support to these new standards by using them in all their designs, orders for materials, and inspections.

The committee is fully aware that even some of the lumber agencies are offering material to the railway purchasing departments on the old rules, and that some mills have not chosen to use the new rules, but the committee is unanimous that it is in the best interests of the railways that all material shall be specified and bought on the new rules.

In the hardwood situation, the committee has had to wait until the industry could come to some conclusions as to the rules under which it will operate. Great progress has been made in developing a set of rules which have secured the support of 65 per cent of the members of the National Hardwood Lumber Association, but which under their rules must receive a two-thirds favorable vote before adoption.

The committee reported that it is keeping in contact with the efforts being put forth by the various public agencies such as the U. S. Department of Commerce in its "Better Utilization of Timber," the U. S. Department of Agriculture promotion of reforestation, the United States Chamber of Commerce in its program of business treatment of reforestation and the National Lumber Manufacturers' Association Trade Extension Program.

Appendix C—Revise Present Specifications for Treated and Untreated Timber Piling

The following specifications are for piles untreated, but contain provisions which are suitable for material to be treated by processes which are specified by the Wood Preservation committee. They relate to round piling. Where sawed timber piles, such as heavy sheet piles, are desired, the committee recommends that appropriate specifications be drawn from the timber specifications already adopted by this Association.

Specifications for Timber Piles

Kinds of Wood

1. The railway will specify the kind or kinds of wood it desires to use, and will designate the kinds it desires for preservative treatment.

2. Piles of different kinds of wood must be delivered in separate lots.

Physical Requirements

General Quality

3. Except as hereinafter provided, all piles shall be free from any defects which may impair their strength or durability as piling, such as decay, red heart, splits in piles to be treated, or splits longer than measured butt diameter of piles not to be treated, twist of grain exceeding one-half of the circumference in any 20 ft. of length, unsound knots, numerous knots or holes, or shake more than one-third of the diameter of pile. Sound knots will be permitted, provided they are not in clusters. The maximum diameter of a sound knot shall not exceed one-third of the least diameter of the section where it occurs, and shall not exceed four inches. A sound knot shall be one which at a depth not greater than its diameter shows wood as hard as that surrounding the knot.

4. All piles shall be cut from sound, live trees, except that fire or blight-killed, or wind-felled timber may be used if not attacked by decay or insects.

5. The tip must be sound.

6. The butt end must be sound in all except cedar piles, which may have a pipe or stump rot hole not more than 1½ in. in diameter.

7. The diameter of a pile in cases where the tree is not exactly round, should be ascertained by measuring the circumference and dividing the number of inches in it by the number 3.14.

8. Piles shall taper uniformly from the point of butt measurement to the tip.

Close Grain

9. If close grain is specified for softwood piles, they shall show on the butt end not less than six annual rings per inch, measured radially over the outer three inches of the cross-section. Douglas fir and Southern pine averaging from five to six annual rings per inch shall be accepted as the equivalent of close grain if having one-third or more summerwood.

Resistance to Decay

10. Piles for use without preservative treatment shall have as little sapwood as possible.

11. Piles for use with preservative treatment shall have no sapwood restrictions, but have, preferably, as much sapwood as possible; in Southern pine a thickness of not less than 1½ in. and in Douglas fir of not less than one inch on the butt end. Care shall be taken to remove as little sapwood as possible while peeling bark. The sapwood shall not be injured by unnecessary axe cuts. These piles shall be designated as sap piles.

Design

Dimensions—First-Class Piles

12. Southern pine and Douglas fir piles shall have the following limiting dimensions:

Length	Diameter 3 ft. from Butt Min.	Max.	Diameter of Tip Min.
Under 40 ft.	14 in.	18 in.	10 in.
40 ft. to 50 ft.	14 in.	18 in.	9 in.
50 ft. to 70 ft.	14 in.	18 in.	8 in.
70 ft. to 90 ft.	14 in.	18 in.	7 in.
Over 90 ft.	14 in.	20 in.	6 in.

13. Red oak, willow oak, black oak, white oak, pin oak, post or burr oak, or cypress piles shall have the following limited dimensions:

Length	Diameter 6 ft. from Butt Min.	Max.	Diameter of Tip Min.
Under 30 ft.	12 in.	18 in.	10 in.
30 ft. to 40 ft.	12 in.	18 in.	9 in.
Over 40 ft.	12 in.	18 in.	8 in.

14. Western red cedar piles shall have the following limiting dimensions:

Length	Diameter 6 ft. from Butt Min.	Max. Widest Part	Diameter of Tip Min. any Point
30 ft. or less	14 in.	22 in.	10 in.
30 ft. to 40 ft.	14 in.	22 in.	9 in.
Over 40 ft.	14 in.	22 in.	8 in.

Dimensions—Second-Class Piles

15. Piles for foundations that will always be completely submerged, and piles for coffer-dams, falsework and sundry temporary work may be of sound, live timber that will stand driving, and need not be peeled. They shall be free from bad knots, decayed timber, shakes and other imperfections which will seriously affect their strength. They shall be of the following general dimensions:

Length	Diameter 3 ft. from Butt Min.	Max.	Diameter of Tip Min.
40 ft. or less	12 in.	18 in.	8 in.
Over 40 ft.	12 in.	18 in.	6 in.

Tolerance

16. Dimensions given are minimum or maximum as stated, but a tolerance of ½ in. less in a given diameter will be allowed in not more than 25 per cent of the pieces of that diameter.

Length

17. All piles shall be furnished on order cut to any of the following lengths: 16 ft. to 40 ft. in multiples of 2 ft. and over 40 ft. in multiples of 5 ft. A variation of six in. in length is allowable, but the average length in any shipment must be equal to, or greater than, the billed length.

Straightness

18. Piles shall be free from short or reversed bends, and free from crooks greater than one-half the diameter of the pile at the middle of the bend. A line drawn from the cen-

ter of the butt to the center of the tip shall lie within the body of the pile.

Manufacture

19. All knots and limbs shall be trimmed or smoothly cut flush with the surface of the pile. Ends must be cut square with axis of pile.

20. When specified, piles must be peeled of bark, including the inner skin soon after cutting so that the piles are smooth and clean.

Inspection

Place

21. Piles will be inspected at suitable and convenient places satisfactory to the railway, at points of shipment or at destination. Piles will be inspected at points other than the railway's property whenever in the judgment of the railway there is a sufficient number to warrant it; but the shipper shall provide accommodations for the inspector at the expense of the railway, while away from rail or steamer lines, and shall transport him from and to a railway station or steamer landing.

Manner

22. Inspectors will make a thorough examination of each pile. Each pile shall be judged independently without regard for the decisions on others in the same lot. Piles too muddied for ready examination will be rejected. Piles will be turned over as inspected, at the expense of the producer.

Manufacture

23. Piles shall be inspected for workmanship and conformity with these specifications in all respects.

Delivery

24. Piles delivered on the premises of a railway for inspection shall be stacked not less than 10 ft. from the nearest rail of any track, or from highways, at suitable and convenient places, but not at public crossings, nor where they will interfere with the view of trainmen or of people approaching the railway. Piles shall be stacked in a secure manner in order that they shall not roll onto the railroad tracks or highway.

25. Each stack shall have fastened to it a tag on which is written the owner's name and address, the date when stacked, and the number of piles of each kind of wood in the stack. Piles for use without preservative treatment and those for preservative treatment shall be stacked separately.

26. All piles are at the owner's risk until accepted. All rejected piles shall be removed within one month after inspection, if required by the railway.

Shipment

27. Piles forwarded in cars or vessels shall be separated therein according to the kinds, sizes and lengths if inspected before loading, or as may be stipulated in the contract or order for them.

Appendix D—Supply Yards for Standard Trestle Timbers Throughout the Country

A questionnaire was sent to members of the Association in order to get the reaction to a proposal for supply yards. Eighty-two replies have been received, of which 37 are from chief engineers, 4 from store department officials, and the balance from other railway officers, such as engineers maintenance of way, engineers of bridges, superintendents of bridges, etc.

Question 7—Should the Association recommend to producers the establishing of commercial yards?

Of the chief engineers 23 are opposed, three are in favor, and the other 11 are either non-committal or have given qualified answers. Of four store department officers, none favor this recommendation. Of the remaining 41 answers, 22 are opposed to the recommendation, 9 are in favor of it, and 10 are non-committal or gave qualified answers.

Question 8—Should the Association recommend the establishing of joint railway supply yards?

Of the chief engineers 24 are opposed, 3 are in favor, and the other 10 are non-committal or gave qualified answers. Of the four store department officers none favored such yards. Of the remaining 41 answers, 23 are opposed, 5 are in favor, and 13 are non-committal or gave qualified answers.

Question 4—Where should such yards be located to serve you?

Included in the 37 replies from chief engineers, 26 separate locations are recommended and no two recommended the same city. In the other replies, mention is made of 35 different locations, Jacksonville, Florida, being the only one mentioned twice.

Question 6—Same as question No. 4 except that it relates to joint railway yards.

Chief engineers mentioned seven locations, no city being mentioned twice. In the other replies mention is made of 27 different cities, Duluth, Minnesota, being the only one mentioned twice.

With the above data it would appear that it would not be possible, at the present time for the committee to make a favorable recommendation as to the establishing of commercial yards or yards operated jointly by a group of railways.

Discussion

[The report was presented by Chairman W. E. Hawley (D. M. & N.), who called on sub-committee chairman C. J. Hogue (West Coast Lumber Association), who outlined the work on grading and classification of lumber. The report was accepted as information, following which Chairman Hawley presented the report on specifications.]

M. Hirschthal (D. L. & W.): I want to call attention to the clause, "Piles for use without preservative treatment shall have as little sapwood as possible." Couldn't that be made a little more definite? As little as possible does not mean very much as a clause for rejecting a pile not coming up to the specification.

Chairman Hawley: The committee tried to put in some percentage, something like 85 per cent or some such value, but because of the difference in different kinds of wood, differences in thickness of the sap and differences in the way of expressing it, the committee concluded that the most practical way in the general specification was to put it in this form.

[The specifications for timber piles were adopted for inclusion in the Manual. F. M. Hawthorne (Penna.) then presented the report of the sub-committee on supply yards.]

R. H. Ford (C. R. I. & P.): It strikes me that this is one of the subjects that a committee ought to be able to make a more constructive report upon, whether it is progress or otherwise. It is pretty largely a question of marketing, a question of finance, and there are other related questions connected with it beyond the mere material feature. I am wondering whether the committee won't take into consideration making a definite pronouncement one way or the other before the convention next year.

Chairman Hawley: The committee has thought that there were possibilities for some economies to be introduced into the railroad use of timber by pooling their source of supply. There were two chances either in combining between different railroads to pool their supply under railroad control, or to encourage private business so to locate its depots of supply of usual sizes of heavy timber that in the case of emergency these supplies could be called upon to supply the needed material for replacement. Some initiative has already been taken by some of the producers of heavy timber, to supply depots where this material can be secured. I think, however, that there is still a feeling on the part of those in the railroad field that they want the source of supply of timber closer than in a pool of other railroads or in private hands, and they desire to emphasize the feature of each road trying to anticipate its own future requirements by buying and maintaining stocks of materials on its own property.

[The president then introduced P. A. Bloomer, general manager of the Louisiana Long Leaf Lumber Company.]

Mr. Bloomer: These grading rules undertake to describe and limit the defects in the several grades so that any intelligent man can correctly inform himself as to their application. From some quarters comes a demand that an additional defect be covered by these rules, that of shrinking and swelling.

This defect is caused by either excessive or insufficient moisture in the lumber. The removal of any of the free water apparently has no effect on the physical properties or the shrinkage of the wood. It is when the imbibed water begins to leave that the lumber begins to shrink, and it will continue to shrink until all this moisture is driven out.

In order to hasten the departure of this imbibed water and incidentally surround the operations with better drying facilities and humidity conditions than may obtain in the open air, steam dry kilns are employed. In their operation many problems are presented.

Lumber of the same species, for that matter from the same tree, will differ as to the amount of water it contains. Frequently lumber cut from butt logs requires more time for drying than that from the top logs, but the lumber must be all put in the kiln together and the humidity and temperature conditions so regulated that no damage be done to the lumber.

It is imperative that we know when the lumber is to be removed from the kiln. When the lumber emerges from the kiln some of it will probably approach the bone dry condition, while the balance will vary in its content of moisture, but not much above the mark set by the operator in the beginning.

Wood is hydroscopic. Even though it were possible to drive out every bit of the moisture in the drying process, when later exposed to the air, it will effect a balance with the moisture in the atmosphere.

The task of ascertaining moisture content requires great care, else incorrect results are probable. There is only one accepted way of doing it. It is open to a great many errors. If it is not cut a distance from the end it will not be representative.

Then there is the question, what is bone dry or oven dry and the point to which we must go to figure the moisture content. Many maintain that absolutely dry wood cannot be secured for the purpose of this calculation because chemical destruction sets in before all the water is evaporated. Certainly in the case of yellow pine there is an amount of oil, turpentine, etc., which will vaporize with the moisture which tends to incorrectly indicate a higher moisture content.

Knowing that green lumber will eventually shrink, some engineers and architects have placed a moisture limit in their specifications. In order to be on the safe side, many of them have put a figure so low that to my mind it is unattainable.

Individuals get nowhere. But if this association would appoint a committee to work on this subject and let our association have a committee to co-operate with you, I am quite sure the results will be beneficial.

[Having completed its report, the committee was excused with the thanks of the association.]

Report of Committee on Rules and Organization

W. C. BARRETT (L.V.)
Chairman

M. M. BACKUS (I.C.)
D. P. BEACH (Penna.)
R. G. BOWIE (C.& W.I.)
H. L. BROWNE
J. F. BURNS (L.& N.)
E. N. BURROWS (Cornell U.)
P. D. COONS (C.B.& Q.)
J. L. DOWNS (I.C.)
H. H. EDGERTON (C.G.W.)
J. M. FAIR (Penna.)
A. B. GRIGGS (A.T.& S.F.)
E. F. GORMAN (Reading)
H. H. HARSH (B.& O.)
A. A. JACKSON (F.E.C.)

W. C. Barrett

E. H. BARNHART (B.& O.)
Vice-Chairman

J. L. JAMIESON (C.P.R.)
B. R. KULP (C.& N.W.)
H. G. LAIRD (A.C.L.)
W. C. MACK (C.R.I.& P.)
R. D. MARTIN (C.R.R.of N.J.)
J. A. PEABODY (C.& N.W.)
H. J. PFEIFER (T.R.R.A.of St.L.)
R. N. PRIEST (A.T.& S.F.)
J. W. STEVENS (N.Y.C.)
C. H. TILLETT (C.N.R.)
R. E. WARDEN (M.P.)
W. H. WHEATON (C.W.P.& S.)
F. B. WIEGAND (N.Y.C.)

THE SUBJECTS of the committee were as follows:

(1) Revision of the Manual (Appendix A);

(2) Rules for the guidance of employees of the Maintenance of Way Department, including (a) duties of motor car operators and maintainers; (b) rules for dressing ballast; (c) rules for maintenance of bridges and other terminal structures, collaborating with the proper standing committees (Appendices B and C); and

(3) Study the titles below rank of division engineer, which are employed to designate positions of corresponding rank in maintenance of way service, and make recommendations that will promote uniformity in nomenclature.

It recommended: That the changes in Appendix A be approved and substituted for the present recommendations in the Manual; and that Appendices B and C be received as information.

Appendix A—Rules for Guidance of Maintenance of Way Employes

Collaborating with the proper standing committees, the committee recommended a number of changes in and additions to the present rules in the Manual.

Under "Track," "Ties," Rule 695, "Storage of," the following sentence was added: "Decayed ties or wood must not be used for sills." Under the same main head, the following new rules were recommended:

Method of Renewal: 709. Any kind of tie which starts to split in track should have an anti-splitting device applied promptly.

Dating Nails: 711. When dating nails are applied after the tie is in the track they must be driven the same day the tie is inserted.

712. The section foreman must see that marks or nails intended to identify ties are not injured or destroyed.

Under the head "Track Spikes," rule 765 becomes rule 764 and the first part of the rule has been changed to read as follows:

Spikes must be started and driven vertically and square, and so driven that the face of the spike shall come in contact with the base of the rail.

The following new rule 765 was recommended:

Where track is to be spiked to standard gage, the rail must be held against the gage with a bar while the spike is being driven.

Under the head "Ballast," the present rules 780, 793 and 791 under "Cross Section," were changed to the following new rules:

General

780. The kind and amount of ballast to be applied should be determined by the proper official.

781. The division engineer should lay his plans for work train service before the division superintendent in order that there may be a clear understanding of what is desired to be done.

782. Speed restrictions must be arranged for in accordance with operating rules before track is disturbed and must be maintained until track is in safe condition for schedule speed.

783. Section foremen must provide proper protection by slow order, caution signs, or flag, or all of these, if necessary, when raising track, and must, except in emergency, raise against the current of traffic, where there is more than one track. A long easy runoff must always be prepared ahead of fast passenger trains.

784. A careful inspection of pit tracks and appurtenances must be made and everything put in serviceable condition if the ballast is to be secured from a railway company pit or from one for which the company is responsible.

Preparatory

785. Preparatory to placing ballast, the roadbed must be widened, if necessary, to bring it to the A. R. E. A. standard width, by dumping material alongside of the track and spreading it to the required width and slope, by the use of a material spreader, if available. Where necessary to raise the roadbed level, porous material must be used to avoid the forming of water pockets.

786. All bank widening must be done far enough in advance of the ballasting work so that there will be no interference with progress of the work.

787. Where directed by the division engineer, preparatory to the distribution of new ballast, all old ballast and unsuitable material must be removed to the bottom of the ties, for the full width of the roadbed, the old ballast, cleaned, and the unsuitable material used for widening embankments or for other purposes. At the same time, all ties requiring renewal must be replaced and the ties properly spaced, if necessary. The track must be accurately gaged as the new ties are being spiked up. Old ties must be disposed of as directed.

788. Ballast grade stakes must be set after the ditching, bank widening, skeletoning and re-tieing have been done and before the ballast material has been dumped and spread. It is desirable to avoid, as far as possible, interference with the stakes, yet to have them available as a guide for the unloading of ballast.

789. All drains required to take care of water from between tracks must be placed before the ballast is unloaded.

790. Stone and hard slag ballast must be cleaned when so foul as to prevent proper drainage. Cleaning should be to the sub-shoulder and where cribs are cleaned, to the bottom of ties, but if the cribs are not cleaned, cross ditches should be cleaned at least every rail length but no cross ditch should be placed at any rail joint. Cleaning between tracks should be to a depth of six inches or more below the bottom of the ties.

Unloading

791. When old ballast has been thoroughly cleaned, sufficient new ballast should be unloaded to make the first raise, which is usually made by shovel tamping the ties. When ballasting or surfacing track out of face, both rails must be raised together.

792. Cars for transporting ballast must be carefully chosen with regard to the work to be done. If for raising track, center dump cars should be used and ballast spread with plow or tie drag. When unloading ballast for a parallel track, side dumps are preferred, especially when air operated. Conventible cars where the sides swing out and up, when used with side plow and unloading engine drum and cable, are satisfactory when dump cars are not available.

793. Ballast shall be unloaded by dumping or plowing as the cars provided permit. If the ballast be in center dump cars, it must be unloaded by having one or more cars opened a little at a time and allowing the desired amount of ballast to flow out as the train is slowly moved along. If the ballast be on flat or open side cars, it shall be plowed off by means of an unloading machine while the train is standing or moving at such a rate of speed as to provide the desired amount of ballast.

794. The unloaded ballast must be leveled down by means of a plow or a spreader, consisting of a heavy timber placed in front of the leading pair of wheels of the rear truck and so constructed and used as to avoid sliding of the car wheels on the rail.

795. When unloading ballast, care must be exercised to secure proper distribution and avoid waste.

Ballasting

796. In using jacks, they must be placed outside the rail and close enough together to prevent undue bending of the rail or overstrain of the joints. When the roadbed material is heavy or holds to the ties tenaciously, it is sometimes necessary to place three or more jacks per rail length. Jacks should be worked in pairs directly opposite each other, and a sufficient number should be used simultaneously, so that no jack will raise the rail more than four inches above its level at the next succeeding jack or place of support.

797. In gravel, stone, chats, chert, slag, hard burnt clay and cinders, the ties must be tamped from fifteen inches inside the rail out to the ends. The end of the tie outside of the rail must be tamped first, and if possible, a train allowed to pass over before tamping on the inside of the rail. The space under the rail must be tamped well. The center of the tie must not be tamped.

798. In earth or clay ballast the ties must be tamped from eighteen inches inside the rails out to the end. The end of the tie outside of the rail must be tamped first, and if possible, a train allowed to pass over before tamping the inside of the rail. The space under the rail must be tamped well. The center of the tie must be tamped loosely with the blade of the shovel. The dirt or clay between the ties must be placed in layers and firmly packed with the feet or otherwise so that water will quickly shed. The earth must not be banked above the bottom of the ends of the ties, the filling between the ties must not touch the rail, and the middle of the track should be as high, or higher, than the top of the rail.

799. Where track is electrically bonded, the ballast must be kept at least one inch below base of rail. At road crossings, platforms, etc., where this is not practicable, rails may be insulated by painting them with an asphaltum or tar product, and good, clean stone mixed with the same material may be used for at least one foot each side of rails.

800. Where raise is sufficient to require a filling lift, a preliminary surfacing gang must follow the unloading as closely as the regularity of the ballast supply will permit.

801. The amount which the track should be raised at one lift will depend upon the depth of ballast to be applied. Usually, track should not be raised more than six inches at a lift. Both rails must be raised at one time and as nearly uniformly as practicable.

802. The "filling lift" must be made by jacking the track up to the required height and the ballast then forked or shoveled in and worked to as uniform a surface as possible by the use of shovels. It shall then be left to be compacted by traffic, but a small "lookout" gang must go over it after a few trains have passed and pick up any spots that show too great an inequality of settlement.

803. After a few days, depending upon the amount of traffic over the track, another lift shall be made, either another filling lift or a finishing lift, according to the depth to which the track is to be ballasted. If another filling lift, it must be made in the same manner as the first one.

804. When the track has been raised to within two or three inches of the final grade and property compacted, a finishing lift must be made by jacking up the track to the desired grade, and the necessary ballast forked or shoveled in and then driven to place by the tamping machines, tamping picks or bars, if rock or heavy ballast is used. Shovel tamping should be used with gumbo, cinder or light sandy gravel ballast. In making all lifts, the spot board and level board must be used with care, and the track brought to surface.

805. Center stakes must be set for the alignment before the finishing lift is made, and the final alignment must conform to the center stakes.

806. The track must be placed in good alignment before the finishing lift is made, but a lining and surfacing gang shall follow one or two days' work behind the finishing lift to pick up all low spots and give the track the final alignment.

807. After the track has been given final line and surface, the track center shall be filled in to the required depth and ballast dressed out to the proper shoulder or toe, using a template if necessary to secure the standard section.

808. Boulders, clinkers or any refuse from the ballast must be removed and disposed of so as to not disfigure the right of way and interfere with the mowing.

809. The following tools should be used: For stone or slag ballast—shovel, tamping pick, tamping machine and stone fork; for gravel, chats, chert, hard burnt clay, or cinder ballast—shovel, tamping pick or tamping bar; for earth or clay ballast—shovel or tamping bar.

810. When not surfacing out of face, as in the case of picking up low joints or other low places, the general level of the track must not be disturbed.

Under the main head, "Lining and Surfacing," the following was added to rule 832, Gaging—"in which case gage must be widened to correspond with widened flangeway," making the new rule read as follows:

Where frogs occur on the inside of curves, the gage at the frog must be standard, unless a frog with widened flangeway is used, in which case gage must be widened to correspond with widened flangeway.

Under the head "Road Crossings," the following rule was recommended:

883. Holes or pockets in bituminous crossings must be repaired as soon as they appear and a small quantity of material should be kept on hand for this purpose.

Under the head "Water Service," three new rules, under the sub-head, "Reading and Testing Meters," were suggested as follows:

1759. Employee must make sure water meter is registering before attempting to read it.

1760. Employee must note the values of the unit on each dial and that one complete revolution of the pointer is equal to one division on the dial of next higher value.

1761. To test meter, employee must weigh the water delivered through one complete revolution of the pointer on the first dial of the meter, allowing sixty-two and five-tenths pounds to the cubic foot of water registered. If this method is impracticable meters may be tested in place by using a hose or pipe from the outlet of meter to a test meter of known accuracy.

Appendix B—Rules for Handling, Framing and Storing Treated Piling and Timbers

The following rules were submitted as information by the committee:

1. In handling any tool that will puncture or otherwise injure the treatment must not be used.
2. Care must be used in unloading piling or timbers to avoid cracking or otherwise injuring them.
3. Piling must not be bored for staging.
4. Piling must not be adzed to frame sway braces.
5. Sway braces must be fitted from the bottom and any cutting found necessary must be made at the top.
6. Wherever it is necessary to cut treated piling or timbers or they become scarred or abraded, the abrasion must be carefully trimmed and there must be applied to the cut or abraded surface, three coats of hot creosote oil and surface must be covered with roofing pitch.
7. Before caps are placed and following the brush treatment, the pile heads must be covered with a tar or asphaltic fabric.
8. Hot creosote oil must be forced in all holes before driving bolts. Unused holes must be likewise treated and plugged with creosoted plugs.
9. Piling or timbers must not be cut or bored below high water mark.
10. Pilings must be driven as soon as possible after treatment. When necessary to store them, they must be stacked closely on the ground free of all vegetation and the top of the stack covered with earth to prevent checking.
11. All unused or untreated piling or timbers must be removed from the water in the vicinity.

Appendix C—Rules for Maintenance of Other Terminal Structures

The committee submitted the following rules for information:

Machine and Other Shop Buildings

(1) Where fans are used, special attention should be given to their maintenance, and duplicate of wearing parts should be kept on hand at all times.

Oil Houses

(1) Oil houses at terminals should be separated from other buildings.

(2) Oils that are stored in large quantities should be delivered to the tanks in the house direct from tank cars. For oils that are stored only in small quantities, provision should be made for delivery to storage tanks from barrels by pipes through the floor.

(3) The delivery system from the storage tanks to the faucets should be such that the oil can be delivered quickly and measured automatically. The delivery should also be such that there will be a minimum of dripping at the faucet and that the dripping may drain back to the storage tanks.

Coaling Stations

(1) Special attention should be given to maintenance of bins, pens, chutes and working apparatus of gravity type coaling stations.

Ash Pits

(1) Where brick or concrete materials form any part of the support of the track over the pit, particular attention should be given to the maintenance of these parts.

(2) Approaches to pits and fastenings to steel beams should be given constant attention.

(3) Water connection should be provided and strict supervision maintained to see that when fire is dumped from locomotives that water is immediately applied in order to prevent destruction of the pit walls and track supports.

Turntables

(1) All refuse and dirt must be kept off the deck and out of the pit at all times.

(2) The center bearing of turntables must be kept clean and properly lubricated.

(3) At stated intervals the turntable should be jacked up and center carefully examined, cleaned and lubricated.

(4) Top flanges and cross bracing of turntables must be kept clean.

(5) Turntables should be cleaned and painted as provided for iron and metal structures, so as to prevent corrosion.

Track Scales

(1) All track scales should be numbered and referred to by number and location.

(2) Extensive repairs to scales, such as renewal of or sharpening of pivots, should be made in a properly appointed shop.

(3) Track scales must be kept well drained, free from dirt, snow and ice, and pit must be cleaned out when necessary. In removing snow and ice, salt must not be used.

(4) The best rust preventative obtainable should be applied to pivot and heavy steel bearings, but it should be so applied as not to interfere with the proper working of the scale.

(5) Where compressed air facilities are available provision should be made for loose hose connection so that dust and dirt can be blown off of the scale.

(6) Where compressed air facilities are not available provision should be made for connections with weigh engines for blowing dust and dirt from scales as may be required.

Discussion

[Chairman W. C. Barrett (L. V.) presented the report of the committee, introducing the various sub-committee chairmen. B. R. Kulp (C. & N. W.) presented Appendix A and *moved that the rules recommended be approved for inclusion in the Manual. The motion was carried without dicussion.* The committee reported progress on the subject of the duties of motor car operators and maintainers in Appendix B, and it was pointed out that rules for dressing ballast were incorporated in Appendix A.

H. F. Pfeifer (T. R. R. A. of St. L.) presented as information the rules for the maintenance of bridges and other terminal structures, and they were so received. A. B. Griggs (A. T. & S. F.) presented as information the rules for other terminal structures found in Appendix C and they were likewise so received. This concluding the report, the committee was excused with the thanks of the association.]

Little Rollo and His Pop*

Chapter II. Wherein a visit is paid to the A. R. E. A. convention and Rollo's mind is much improved by listening to the deliberations of that assemblage

"GEE, POP," said Rollo, as he entered the convention hall, "look at all the men. Are they all locomotive engineers?"

"Hush, Rollo," said the father as he clapped his hand over his young hopeful's mouth, "don't let any them hear you say that. Why, they nearly mobbed a clergyman last year at the banquet for making the same mistake."

"Shucks," said Rollo, in his high treble, "I thought they did something interesting. Who are they all anyhow?"

"Well, now, sonny, I'll tell you," said the old man, as he scratched his head, "there are chief engineers, assistant chief engineers and principal assistant engineers. Then there are engineers maintenance of way and maintenance of way engineers. There are construction, roadway, division, consulting and civil engineers. In addition, there are valuation, resident, masonry, structural and bridge engineers. Then there are fire prevention, electrical, water, industrial, chemical, office, sanitary, architectural, contracting, location, transport, testing, pilot, standards, grade crossing and inspecting engineers. Besides those, there's metallurgical, track elevation, general, special, senior, junior, motive power, hydraulic, sales, service, designing, right-of-way, surveying, cost, timber preservation, accounting, city track, field, reconnaisiance, concrete, track appliance and rapid transit engineers. Nearly all of these men have assistants. I might mention also, the engineering professors and the engineering editors."

Rollo gaped at his father, as the latter stopped for breath: "Gee, whiz, Pop, you know everything, don't you?", he said at last.

"Well, nearly everything," said the father, as he gave the bright young man a quarter.

Rollo was somewhat awed by his unfamiliar surroundings but such an ebullient youngster could not remain awed for long, and presently he was asking questions again, as was his invariable habit, morning, noon and night.

"Pop," he inquired, "what is that long table up in front?"

"That, my son," said his patient parent, "is the speakers' table."

"Well, who is the man with the wooden hammer?" was the youth's next question.

"The man with the gavel is D. J. Brumley, president of the association," replied Pop.

"Oh," returned Rollo, "is that why he looks so proud."

"No," replied Pop, "he is proud because he raised in his garden last year some of the largest and best tomatoes ever grown in the vicinity of Chicago."

"Does his engineering training help him in his gardening?" asked Rollo.

"It does," said his father firmly, and that was that.

Presently Rollo squirmed in his chair and it was evident that another of his interminable questions was in the process of formation.

"What railroad does President Brumley work for, Pop," he asked.

"The Illinois Central."

"Who is that youthful-appearing man with the glasses over there?"

"That, my boy, is Dick Knowles, chairman of the Committee on Arrangements, chairman of the water Service Committee, etc."

"What railroad does he work for, Pop?"

"The Illinois Central."

"Who is the man with all the papers, Pop?"

"That is Frank Judd, chairman of the Building Committee."

"What railroad does Mr. Judd work for, Pop?"

"The Illinois Central."

"Who is the slender gentleman near Mr. Judd?"

"That is Jim Farrin, chairman of the Committee on Economics of Railway Operation."

"What railroad does Mr. Farrin work for, Pop?"

"The Illinois Central."

"Are there any other Illinois Central men active in the association?"

"Oh yes, my son, a lot of them including L. A. Downs, principal speaker at the banquet tonight who is president of the Illinois Central and a past-president of the association."

"I. C.," said Rollo, "but why is it called the American Railway Engineering Association?"

"Now, Rollo, papa spank."

"Who is the dark-haired gentleman at the head of the class?"

"Oh, that's Mr. Faucette."

"Surely not Mr. Faucet of the water service committee," piped Rollo.

"No, no, no," said his Pop, "nothing like that. Mr. Faucette is to be the next president of the association and is not on the water service committee."

For some time Rollo listened attentively to the discussion, he was all ears, in fact. In the meantime, his Pop had a chance to rest his weary brain. Knowing his son, though, he realized that this condition could not last long and, sure enough, Rollo began to exhibit the preliminary symptoms of another outburst of questions.

"Pop," he piped, "what is 'recommended practice'?"

"Recommended practice," said Pop, "is any practice which has been investigated by a committee, presented to the association, approved by them and recommended as the best practice."

"Do all these men put these recommended practices in effect?"

"How do I know?"

"But do you put the recommended practices in effect, huh, Pop?"

"Rollo, I'll answer no more of your questions today."

*Editor's Note: Little Rollo, the son of a chief engineer, is visiting the convention with his father. A RAILWAY AGE representative, chancing to meet the pair, was so struck by the naive innocence of Rollo, and his fresh, young viewpoint, that he immediately assigned himself as reporter of their conversations. The result is appearing every day.

A. R. E. A. Registration

A TOTAL of 644 members and 189 guests, or 833 persons registered at the A. R. E. A. convention yesterday. This compares with a registration of 547 members and 221 guests, or 768 persons on the first day last year and of 554 members and 122 guests, or a total of 676, on the opening day in 1926.

A. R. E. A. Registration

Members

A

Abbott, R. B., asst. gen. supt., Reading, Reading, Pa.
Ackerman, F. J., sig. engr., K. C. T., Kansas City, Mo.
Adams, Lem, road. asst., pres. staff, U. P., Omaha, Nebr.
Adams, L. L., roadm., L. & N., Louisville, Ky.
Akers, J. B., asst. to vice-pres., Southern, Washington, D. C.
Alexander, F. W., engr. maint. of way, Can. Pac., Winnipeg, Man., Can.
Allen, E. Y., val. engr., Reading, Philadelphia, Pa.
Ambrose, J. R. W., chf. engr., T. T., Toronto, Ont., Can.
Anderson, Anton, engr. maint. of way, C. I. & L., Lafayette, Ind.
Anthony, F. D., West Chicago, Ill.
Anthony, W. R., water treat. plant supvr., M.-K.-T., Parsons, Kans.
Archibald, H. C., div. engr., B. & M., Salem, Mass.
Armstrong, C. E., asst. engr., N. & W., Portsmouth, O.
Armstrong, J. E., asst. engr., Can. Pac., Montreal, Can.
Arn, W. G., asst. chf. engr., I. C., Chicago.
Arter, J. B., asst. engr., B. & O., Akron, O.
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Butler, W. J., asst. cost engr., H. V., Logan, O.
Butler, W. S., supt., C. & O., Russell, Ky.
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Cory, N., Jr., San Antonio, Tex.
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Curtis, A., B. & A., Gloucester, Mass.
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Davis, H. E., Grasselli Chemical Co., Cleveland, O.
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Kipp, A. R., Battey & Kipp, Chicago.
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Long, T. Conrad, Kansas City, Mo.
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Neilan, R. H., asst. engr., N. P., Missoula, Mont.
O'Brien, W. H., engr., Southern Pine Association, Chicago.
O'Donnell, Alexander, civ. engr. dept., Lewis Institute, Chicago.
Orland, Frank A., instr., University of Illinois, Urbana, Ill.
Painter, J. F., supvr. of goods, Glasgow.
Peterson, J. H., asst. const. engr., H. V., Enterprise, O.
Petri, Phil G., asst. engr., B. & O., Baltimore, Md.
Piesch, Henry, asst. engr., U. P., Omaha, Nebr.
Plow, G. L., instman., C. R. I. & P., Trenton, Mo.
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Putney, F. C., inspr., Penna., Harrisburg, Pa.
Ray, C. A., chf. clk. to prin. asst. engr., M. P., St. Louis, Mo.
Reeves, W. T., Robt. W. Hunt Co., Chicago.
Rohe, E. J., supvr. bldgs and br. and tr., C. & O., Cheviot, O.
Rose, L. S., asst. engr., G. N., New York City.
Ross, L. G., C. & O., Richmond, Va.
Ruggles, T. D., roadm., Can. Pac., Boissevain, Man., Can.
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Schmucker, L., asst. engr., B. & O., Akron, O.
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Smith, G. R., supvr. of tr., G. N.
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Stephenson, E. C., gen. boiler inspr., C. & O.
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Stone, B. H., C. R. I. & P., El Reno, Okla.
Stuart, J. C., Robt. W. Hunt Co., Chicago.
Swanson, C. P., Saskatoon, Sask, Can.
Talman, H. S., asst. cost engr., C. & O., Richmond, Va.

(Registration continued on page 560-D112)

The Board of Direction Met at the Stevens Hotel Sunday

Reading from left to right:—F. J. Ackerman (K. C. T.), H. G. Morgan (I. C.), W. M. Post (Penna.), G. H. Dryden (B. & O.), F. W. Bender (C. R. N. J.), C. F. Stoltz (C. C. C. & St. L.), R. H. C. Balliet (A. R. A.), C. H. Tillett (C. N.), L. Wyant (C. R. I. & P.), P. M. Gault (M. P.), A. H. Rice (D. & H.), H. H. Orr (C. & E. I.), W. F. Zane (C. B. & Q.), W. M. Vandersluis (I. C.), R. B. Elsworth (N. Y. C.) and J. E. Saunders (D. L. & W.).

Signal Section's Second Day Busy

Seven committee reports and election of officers feature closing day's sessions

THE SECOND day of the annual convention of the Signal Section, A. R. A., at the Stevens hotel opened at 10 a. m. yesterday morning with C. H. Tillett, Canadian National, as chairman. Seven committee reports were presented during the day. Following the election of officers, described in detail elsewhere in this issue, the meeting adjourned at 4 p. m. The 1928 stated meeting is scheduled to be held at a southern city, but agreement has not yet been reached between Cincinnati, Ohio, Galveston, Tex., and Atlanta, Ga. This will be decided at the meeting of the Board of Direction.

Report on Signaling Practice (Continued)

THIS COMMITTEE presented the remaining portions of the report, including signal aspects, indications and names for color-light signals, and a resume of devices other than automatic train control. The preceding part of this report covering recommendations made by this committee to the Committee on Operating Rules of the Operating division, A. R. A., in connection with semaphore signal aspects, indications and names, was presented Monday afternoon and was reported in yesterday morning's issue, March 6.

Devices Other Than Automatic Train Control

Reports on fatal accidents investigated by the Bureau of Safety of the Interstate Commerce Commission—82 in 1926 and 31 more prior to July 20, 1927, total 113—showing causes and recommendations, have been analyzed to learn if possible how many would have been prevented by automatic stops and how many by "other safety devices." We find:

(a) 35 derailments—and the following collisions:
(b) 2, manual block;
(c) 1, interlocking;
(d) 12, no block system, including some open or damaged switch points, one, fault of officers, etc.;
(e) 13, automatic block;
(f) 1, train and hand car;
(g) 3, train and gas car;
(h) 2, yard;
(i) 1, train and automobile;
(j) 1, controlled manual—(It is stated) would have been prevented by continuous track circuits;
(k) 1, automatic block, 2 M.W. motor cars;
(l) 1, interlocking, "had the derail functioned properly, this accident would not have occurred";
(m) 1, automatic block and train stop in service; engineman forstalled.

In none of the above 74 cases is any recommendation made for installation of "an adequate block system or automatic train stop or control."

(n) 1, automatic block, excessive speed; automatic speed control recommended;
(o) 8, automatic block; automatic train control recommended;
(p) 15, no block signals, and
(q) 10, manual block signals—"had an adequate block system been in use on this line, this accident probably would not have occurred. An adequate automatic train stop or train control device would have prevented it."
(r) 1, intrlocking; automatic train control recommended;

(s) 1, controlled manual; automatic train control recommended;
(t) 1, no block system; adequate block system would have prevented;
(u) 1, no block system; should install block system;
(v) 1, manual block; an adequate train stop would have prevented.

As it has been the established practice of the Bureau of Safety for a number of years to call attention to the desirability of an adequate block system or an adequate train control device whenever such devices might have been of use, it is fair to assume that in the 73 cases where no recommendation is made, they would not have done any good and in one case, it was installed and did not work and analysis shows that practically all of them, except the derailments, occurred at low speeds or under such circumstances that they would probably have occurred anyway. There remain, therefore, 39 collisions out of 78 to be considered.

Attention is called to the 10 under "manual block," where it is said "had an adequate automatic block system been in use, this accident probablv would not have occurred; an adequate automatic train stop or train control device would have prevented it," and the question arises, would something less expensive have produced the same desired result?

There were in all 13 collisions of trains with trains in manual block territory (collisions between trains and hand cars, workmen's gas motor cars, which will not operate track circuits, and automobiles and those in yards, have been omitted from this tabulation); of these:

1 Head-on, due to issuance of clearance to one of the opposing trains to make a meet in the block;
3 Passenger trains given permissive cards or signal on freights ahead, in one of which cases the director makes the statement that an adequate automatic block system would probably have prevented it—nothing is said about automatic stop or speed control, as most of these rear-end collisions occurred at slow speeds;
2 Freight trains following another on permissive; in only one of these cases is an automatic stop suggested;
1 Train ran signal and collided head-on;
1 Train on siding received clearance card to proceed after two trains had passed, the entire crew went to sleep; awoke when first train passed; engineman "was under the impression" that both had gone and pulled out. In this case, the remark is made "had an adequate block system been in use, etc. * * * an adequate automatic stop, etc."—the regular paragraph used in such cases.

Would not an adequate manual block system at least presumably have prevented at least half of these collisions?

What is an adequate manual block system? It is the opinion of this committee that it is a system superimposed upon the system of train rules, as shown in the standard code of the A. R. A., supplementing but not supplanting such rules, and under which absolute block for all opposing movements of all trains is provided, as well as absolute block for following movements, except perhaps freight on freight.

Absolute blocking insures a real block. Permissive blocking in effect annuls the block protection and permits a train to run with the information that at the time the engineman passed the block signal, the block which it governed was occupied.

Block rules which provide that the first train to enter the block must be on siding with switches set for the main track and so reported before an opposing movement is permitted to enter such block, insure, as far as rules can, a real block system.

The issue of cards to one or both such trains, when a meet is to be made, so that both may proceed toward the siding and each other, with no other check than such cards and train orders is not as "adequate" protection as that afforded by single track automatics, and in fact, it is no block system at all, because the block protection is annulled and train orders depended upon entirely for movements through that particular block.

Similarly, but in less degree (because flag protection may be available) a manual block system which gives a card or a permissive block signal to a passenger train to permit it to enter a block occupied by a freight train or to a freight to enter one occupied by a passenger train, leaves much to be desired in "adequacy."

It is true that, under automatic rules, any train may proceed into an occupied block, but, under the prevailing practice, it must first stop and it may then proceed at slow speed, lookout being kept for a broken rail, train in the block or switch not properly set—the advantage of this practice being that the distance to be so run is usually not much in excess of a mile, while the manual block is usually of such length that such slow movement would seriously delay traffic, which is probably the reason why the Interstate Commerce Commission reports frequently suggest automatic block in place of manual or where no block system is in effect.

Nowhere in these reports, as far as we can see, is any recommendation made as to controlled manual block as an added safeguard, and yet no system employing wayside signals only is safer for head-on movements on single or double track.

The point is that in many cases manual block under proper rules is entirely adequate on portions of railroads now operating entirely under time-table rights and train rules, and is also entirely adequate on those very portions of some roads now equipped with a manual block system if the rules are so revised as to provide real manual block at all times (barring, of course, extreme emergencies) and prevent its annulment under normal operation.

When the traffic becomes so dense that its proper movement requires block stations located at short intervals apart, the installation of automatic signal systems should be made as an economic proposition especially on multiple tracks. Such installations would be reasonably "adequate."

At its inception and in fact ever since, the term train control has been loosely used. Perhaps it would have been better to have distinguished more clearly in the beginning between the automatic stop per se and speed control; as it is, either or both are frequently referred to as "train control."

The primary object was "to enforce obedience to the indications of the fixed (wayside) signals," although the commission recognized the future possibility of operating "without the wayside signals" and by implication at least encouraged such development.

Among the accidents listed above, there were several glaring instances of disregard to such signals in automatic block territory (only one such instance is noted in manual block territory).

In one case of an open switch, no mention is made of an automatic stop, neither is there where two work trains on single track collided owing to misunderstanding between the crews, but in three cases; first, running too fast under approach signal and overrunning the home; the second approached the home too fast; and the third running two signals at caution, the third changed from caution to clear and then running three

more caution signals before running the stop signal and colliding; no mention is made of the automatic stop but train (speed?) control is suggested as the remedy, presumably on the assumption that if, under these circumstances, a stop and forestaller were in use, the engineman would have forestalled in each instance and then proceeded about as he did, expecting (especially in the third case cited) that the signal would at worst indicate caution or approach as he reached it.

It should not be forgotten that, even with speed control, collisions at slow speed are easily possible, and, as indicated in the foregoing, most of the collisions reported were at slow speeds, so that even speed control is not a universal remedy. On the other hand, it is quite possible that it might have prevented some of the derailments had it been so installed as to enforce speed restrictions imposed on account of permanent or temporary track conditions.

One of the outstanding facts noted in these reports is that there were, unless we have carelessly overlooked them, no instances of train order signals being overlooked; only one of manual block signal overrun, and in that case only for a short distance but far enough to cause damage, and, out of the entire 78 collisions, only 10 automatic block signals overrun; that is, only 11 signals were disregarded, the observance of which the "train control" is intended to enforce, and, as pointed out above, in three of these cases "automatic stops" would not have been "adequate" to prevent them.

It is now "well known to the art" and to everybody who is familiar with the developments, that speed control as being installed is of necessity far more expensive to install and maintain than the stop and forestaller—an expense not justified except in a few isolated cases, if at all, to control ordinary steam railroad traffic—in fact, some of the railroads that pioneered in speed control under the first order immediately thereafter took advantage of the commission's revised order permitting the use of the forestaller and installed the stop and forestaller, and one of the pioneers in the development of the continuous system has installed the stop and forestaller on five divisions under both the first and second orders, supplemented, however, by cab signals, while two railroads are operating without wayside signals except those indicating "stop" (and "stay").

These conditions naturally lead us to consideration of the safety device most recently developed, namely the cab signal, **not only as an adjunct** but as a substitute for the **stop and forestaller and eventually** for the wayside signals except at interlockings and where trains must stop and not proceed until further authorized.

The stop and forestaller has at least two distinct and inherent disadvantages:

First: Due to the inability or neglect of the engineman to forestall while proceeding at slow speed, it has caused a number of internal collisions resulting in derailments and buckled freight cars, which, in one case, in turn caused an external collision with a passenger train on an adjoining track. A device intended to prevent collisions which will cause a collision is not entirely desirable.

Second: If a man does forestall, he may run at any speed he pleases. With the intermittent, he ordinarily forestalls or receives a brake application only at the fixed signals, although the device on the locomotive may and has been affected with some types by rails or other objects closely adjacent to the tracks, ordinarily he receives no warning of changed conditions ahead until he sees the next wayside signal ahead; on the other hand, he is perhaps less likely to be called upon to forestall except at the signals, and, therefore, runs less chance of buckling his train if he fails to do so. The continuous operates to apply the stop anywhere through the block if the signal ahead changes to a less favorable aspect, if a switch is opened, if a rail breaks or if a wreck short circuits the track, thereby giving considerably more protection against these misfortunes, but, on the other hand, being controlled continuously, is perhaps more subject to failure through the block under ordinary conditions, and the engineman is perhaps a little more likely to be caught unawares. Neither give any warning or information except by the sounding of a whistle a few seconds before the brakes apply, although, in the case of the continuous, they may be released again if the condition ahead becomes more favorable, or if the restricted condition exists for a very short interval. * * *

In short, information is constantly given of conditions ahead (and of course every change in such condition) without taking control of the train from the engineman, but depending upon the fireman to take the place of the automatic device in emergency. * * *

As an illustration: In the case of the engineman who ran five caution signals knowingly and finally passed the "stop" signal there can be no question that he expected to have the signals clear up (or at least the "stop" signal to show caution) when he approached it. It is fair to assume that, if his locomotive had been equipped with the stop and forestaller, he would have forestalled and proceeded under the same assumption that the train ahead would keep moving. Had it been equipped with a cab signal which indicated "Approach next signal prepared to stop" as he passed the "approach" signal and continued to so indicate all through the block, indicating absolutely that the next signal had not changed and would be found at "stop," is it not also fair to assume that he would have stopped?

A four-indication cab signal would give the three indications usually given by automatic block signals, with the ability to display in addition "Approach restricting" where three-block indications were used or where approaching an interlocking where restricted speed was required on passing the home signal. On four of the divisions of the Pennsylvania, the indications given are clear, approach restricting, approach and caution slow speed. With cab signals, movement may be speeded up if block signal clears up ahead.

Eventually wayside signals other than "stop" (and "stay") may be dispensed with if the volume and nature of the traffic is such that it would not be seriously interfered with, should the cab signal be out of commission throughout a large portion of a run, and, as indicated in the verbal report made on this subject at the 1927 stated meeting, if the automatic wayside signals are eventually abandoned, the blocks may be sub-divided as many times as conditions warrant and trains run regularly slightly more than braking distance apart under clear signals instead of, as under present practice, requiring more than twice braking distance apart before clear signals are displayed.

With the air brake equipment in general use, proper handling of trains requires skill and judgment, which are not present in an automatic device, which as has been well and frequently stated, does not possess a differentiating mentality and will make the same application at the same place on a light engine as on a long passenger train or a heavy freight, introducing, as previously pointed out, dangers which are not introduced by the cab signal.

A careful analysis of collision records in automatic signal territory over a long period of years shows that an overwhelming majority were due to four causes:

First: Running under approach signals at too high speed, assuming that the "stop" signal would change to "approach" before it was reached.

Second: Missing the "approach" signal entirely under adverse conditions of smoke, storm or fog, or because the engineman was asleep, injured or otherwise incapacitated or negligent.

Third: Misreading the signal, or,

Fourth: Reading the signal on an adjacent track.

The signal in the cab, visible under all weather conditions, one for the engineman and another for the fireman, acting in unison, with the added precaution of a whistle to call attention to a more restrictive change in the rare case that the change is overlooked by the two and frequently three men of the crew, checks and guards against all these mistakes and is, in our opinion, the most important of the "other safety devices" provided for in the law, which should be superimposed or substituted for the present automatic signal systems when experience has shown that additional protection is required, instead of installing either the stop and forestaller or speed control—real and complete speed control to be added as a last resort if and when all other means fail to produce the results desired.

Action recommended; acceptance as information.

Discussion

[Chairman W. M. Post (Penna.) resumed the discussion of this report which was not concluded on Monday afternoon owing to adjournment, by presenting that part designated as Signal Aspects, Indications and Names for Color-Light Signals.]

G. H. Dryden: Regarding Rule 285, "Approach Medium Speed." Certainly these two signals do not mean the same thing, therefore they should not be given the same name. The one to the left means medium-speed here, medium-speed beyond. I would recommend that to the committee.

J. E. Saunders (D. L. & W.): I note your reference to the medium-speed having been changed. Where there is a change, is it in the interest of standardization? Did the Train Rules Committee decide that?

Chairman Post: The Committee on Operating Rules of the Operating Division decided the definition for restricted speed as given in this report and reported it to the Board of Directors of the American Railway Association and it has been promulgated to the railroads.

[Chairman Post then referred to "The Utility and Desirability of Safety Devices other than Automatic Train Control," and asked A. H. Rudd (Penna.) the chairman of the sub-committee, to present it. Mr. Rudd read the report and explained certain paragraphs in detail.]

A. H. Rudd (Penna.): Since this report was prepared, the Committee on Train Control of the American Railway Association has taken all the reports, the I. C. C. and others, for two years and has analyzed them. The word permissive block has been misused in this association for a good many years. Permissive block, as the committee refers to it, is the permissive manual block as shown in the standard code. A great many of our people have referred to the stop signal as permissive. They refer to the grade signal as used as permissive. It is not. In the code there is no reference to permissive among the automatic block rules.

[Chairman Post then called upon F. B. Wiegand (N. Y. C.) to report upon that section of the committee's assignment dealing with noteworthy advances in signaling practice which was submitted as information and the committee was then excused with the thanks of the Section.]

Report on A-C. Block Signaling

C. H. Morrison (N.Y.N.H.& H.)
Chairman
T. N. Charles (Sou.)
J. H. Deming (C.of G.)
G. H. Dryden (B.& O.)
W. F. Follett (N.Y.N.H.& H.)
E. N. Fox (B.& M.)

C. H. Morrison

L. F. Vieillard (L.I.)
Vice-Chairman
J. J. Ginty (C.N.)
C. E. Goings (Penna.)
J. J. Larkin (S.B.)
W. K. Saunders (R.F.& P.)
W. L. Scott (R.Co.)

THE COMMITTEE submitted reports on the following subjects:

(1) The committee has co-operated with Committee V in the revision of specifications for portable d-c. voltmeters and ammeters.

(2) The revision of A. R. A. Signal Section Spec. 14328, Signal Lighting and Rectifier Transformers. This revised specification was presented by the committee with the recommendation that it be accepted for submission to letter ballot.

(3) An outline of the various types, frequencies, and applications of a-c. circuits and apparatus as applied to train control, was presented by the committee for the purpose of bringing out discussion on what items

should be included in a proposed specification or specifications on this subject.

(4) Inductive interference of alternating current circuits and supply lines for signals and train control with communication circuits, conferring with Committee No. 7, T. & T. Section.

(5) Protection from lightning.

Inductive Interference

An inquiry pertaining to the inductive effect upon communication circuits originating from signal and train control supply lines with special reference to noise test, transposition and frequency, was sent to 20 of the more prominent railroads of the United States. Of the 75 per cent responding, only two had made noise tests upon the communication circuits. No interference was noted. These two roads also reported the greatest number of conditions that might lead to inductive interference. With the exception of two roads, all of the roads responding reported no interference or inductive effect upon the communication circuits. Both of the roads reporting trouble stated that the telephone lines and supply lines were on the same poles, one having a 110-volt circuit parallel to a communication circuit for a distance of two miles, the trouble was corrected by transposing the supply line at one point, the other having a telephone circuit directly above a 550-volt, 60-cycle supply line, was corrected by using twisted pair for the telephone circuit.

With this one exception, of the 75 per cent of the roads questioned, none of the roads reported finding it necessary to transpose the signal and train control supply lines. The roads from which we had reports covered the subject so comprehensively that we feel justified in anticipating no serious trouble from inductive interference on the communication circuits from any signal or train control supply lines that are used exclusively for that purpose, with the understanding that in cases where there is unbalancing or a tendency to create the slightest noise upon a telephone system that it can be corrected by following out the precautionary measures recommended by Committee No. 7 of the T. & T. Section, as submitted to the Signal Section as "Exhibit D," on page 591 of the 1927 annual meeting advance notice.

Since Committee VIII's report as submitted to the Signal Section at the 1927 annual meeting, Committee No. 7 of the T. & T. Section has not considered any matter that would be of interest to the Signal Section and it is reported that the assignments of Committee No. 7 for 1927-1928 do not include any subject that would affect the Signal Section.

Action recommended, acceptance as information.

Protection from Lightning

The committee reports progress on the subject of lightning protection. In the report presented at the 1927 annual meeting, mention was made that the klydonograph tests would be continued on the underground unshielded line of the Pennsylvania. Further consideration on the part of the committee, however, convinced it that additional extensive study of this particular situation was probably unnecessary, as there was no evidence to show that the conclusions reached, that is, that an unshielded underground line was in the same class as far as lightning protection was concerned as an aerial line, were wrong.

Acting on the committee's conclusions, the Pennsylvania installed a number of lightning arresters on the section of the line where the most of the lightning trouble was experienced. The arresters were spaced at irregular intervals, and in the section protected no lightning trouble has since been experienced. It must be said, however, that thunder storms were not particularly severe over the protected section the past summer, and the immunity from trouble may have been only a coincidence.

The line voltage is 3,300 and the gap setting of the arresters is about 4,000, so that a great increase in the line voltage is not necessary before the arresters will start to work. More arresters have been added lately, and probably more will be added before the next summer season, and the committee expects to be able to report at greater length at the next meeting. The committee does not want to be too optimistic, but the results are certainly encouraging.

The committee has had occasion to investigate an aerial line having a great amount of trouble with transformer primary fuses blowing, and to a lesser extent, transformers burning out. There had also been some trouble with alternating current relays. Many different kinds of arresters were in service, but every thunder storm brought numerous failures. The trouble was traced generally to two causes, poor insulation of the connected instruments, and the use of lightning arresters which did not restrain the surge voltages to reasonable values. The committee believes this case is typical of many in railway signaling work, particularly those lines which have been in service a number of years.

Many of the fuse failures were due to poor insulation of transformer leads and bushings, the transformers being of an obsolete type, where the terminal blocks are above the oil level, and the lead-in bushings inadequately insulated. Lightning flashed over from the leads to the case, short circuiting the line, and, of course, blowing the fuses. The transformer burnouts and relay punctures were also traced largely to poor insulation.

The committee feels that it is necessary to emphasize the fact that the insulation of the line and connected instruments should be kept as high as possible, as otherwise it is useless to expect good lightning protection from arresters of any type.

In this specific case, practically all known arresters had been tried, with little result, and the remedy lies in replacing the old transformers and other instruments with those of modern design, or, if possible, although in most cases it is not, to increase the insulation of the old instruments.

The committee had occasion to study also the case of open line construction entering cable, either aerial or underground. This happens occasionally where open line construction is not advisable through built-up sections, or where joint construction with telegraph and telephone lines is necessary, and where cable is more conveniently used.

As far as the committee knows, almost absolute protection may be obtained by the use of insulating transformers, but if there are a number of locations where open line must be connected to cable, this method is very expensive, and the line loss is prohibitive. As a consequence, a combination of choke coils and arresters is sometimes used, with varying results, as cable punctures occur occasionally.

The committee believes that more research work is necessary before a satisfactory solution to this particular problem is found, although some arrangements of arresters and choke coils seem to afford a considerable measure of protection. Where choke coils are used, it appears to be good practice to install arresters on both sides of the coil and not on the open line side only, as is sometimes done.

The committee has also made some study of low-voltage circuits, and track circuits, and some klydonograph records have been obtained in the past year, but not enough has been learned to report on definitely.

The committee has also started a study of many of the lightning arresters offered for the protection of signal apparatus, particularly as to their ability to restrain surge voltages to reasonable limits. It has come to the committee's attention that even though the break-down voltage of an arrester may be low, when gradually applied, surge voltages of very high value may be built up on a number of the arresters commonly used before they will relieve the line.

Finally, the committee has in mind collaborating and coordinating the available information in the matter of grounding, and hoped to get this together to present at this annual meeting, but has been unable to do so. It will try to get this in shape this coming season.

The committee desires to emphasize the necessity for obtaining low resistance grounds in order to secure the best arrester performance. In practically every case where the resistance of a single ground is high, the use of multiple grounds will greatly improve conditions. If multiple grounds do not sufficiently lower the resistance, then salting must be resorted to. For this purpose, common rock salt is about as good as any salt, although copper or iron sulphate seems to have some advantages in special cases. Whatever salt is used, it should be applied liberally. The ground resistance should be measured as often as possible, not less than once a year.

There are certain facts concerning grounds which have been determined by investigation, which the committee might mention briefly at this time. They are as follows:

The voltage which appears across an arrester and which is dangerous to insulation is dependent on the impedance of the earth connection, and this must be low. Except in special cases, driven grounds are about as satisfactory as any other kind, and are the easiest to install. Solid rods or pipes are about equally efficient. The diameter of the rod or pipe has little effect on the resistance. Any size rod or pipe which can be driven will be satisfactory. The material of which the rods or pipes consist has little or no effect on the resistance, and need not be considered, except, perhaps, where salting has to be resorted to, and the corrosion factor enters. This last point has, however, not as yet been definitely determined.

Grounds should be driven to a depth of about six feet. Further than this is not necessary, except in very dry localities. Multiple grounds should not be spaced closer than six feet, and, of course, the bonding should be thoroughly done.

The leads from the arrester should have as few turns as possible, and the connection to the grounding device should be well made and kept tight.

In June, 1926, an experimental installation of ground electrodes was made near broadcasting station KDKA, in East Pittsburgh, by the Westinghouse Electric & Manufacturing Company and the results, as far as obtained, were explained in the paper presented by Mr. Beck.

Action recommended, acceptance as information.

Discussion

[Chairman C. H. Morrison (N. Y. N. H. & H.) presented this report but asked G. H. Dryden (B. & O.) as chairman of the sub-committee to give that portion of the report relating to signal lighting and rectifier transformers. A motion to **submit this part of the report to letter ballot was made and carried.**]

L. F. Vieillard (L. I.): The sub-committee is desirous of ascertaining whether we are on the right track on the assignment "Alternating Current Circuits and Apparatus as Applied to Train Control."

A. H. Rudd (Penna.): We made a suggestion that the term coder system be used instead of "periodically interrupted."

J. E. Saunders (D. L. & W.): I think what the committee has proposed, "periodically interrupted," is the best way to define it. I notice you say "coder practice." I wonder if it would not be better to say "coder in practice."

Mr. Vieillard: When we speak of the coder, we usually mean the code transmitter. As we spoke of the code here we have in mind the "periodically interrupted" system.

L. F. Howard (U. S. & S. Co.): The expression "code system" would be a safer one to adopt than the suggested one of "periodically interrupted." The idea of periodic interruption quite frequently conveys the idea of cyclic interruption where the period is the same. I can see that some time in the future a code might be introduced that would not be of uniform periodicity. If you adopt the term coder system, you have a broader foundation for any new development than if you use the term periodically interrupted.

Mr. Vieillard: These paragraphs will be considerably amplified, of course. These might be considered as the headings of the various paragraphs. If it is agreeable to everyone, we will call it the coder system.

[The subject of lightning protection as applied to signal power lines and control circuits was covered in a paper presented by Edward Beck of the Westinghouse Electric & Manufacturing Company. In his paper he referred to the necessity of providing an electro-static shield around any circuit, whether it be in an underground cable or in an overhead wire line. When carried underground the desired shielding is most effectively accomplished by metallic-sheathed cable. Mr. Beck also called attention to the value of overhead ground wires as protection against lightning. In this respect he referred to a number of factors affecting the degree of protection afforded by overhead ground wires, including the number of ground wires, their position relative to the circuits protected and to each other, the height of the circuit protected and the ground wires above the earth, the conductivity of the soil and the number and resistance of the earth connections to the ground wires. Under the most favorable conditions he stated that an overhead ground wire may reduce the induced voltage to about 60 per cent of that which would occur without the ground wire protection. Mr. Beck also referred to the presence of voltages as high as 3,500 between the rails and the earth as a result of lightning disturbances. These conclusions have been deduced as the result of klydonograph investigations on a number of track circuits.

That the earth plays an important part in the degree of lightning damage to electrical circuits was also brought out by Mr. Beck. The magnitude of the induced voltages is affected by the soil conductivity. Continuing further in this respect he pointed out the importance of good ground connections in any scheme of lightning protection. A number of charts were shown to illustrate the variation of ground resistance with respect to a number of factors, such as the use of multiple electrode grounds, the application of various chemical salts to the earth adjacent to the electrodes, how quickly such an application takes effect, how long the decreased resistance effect may be expected to last, and the corrosive influence of such salt applications. In concluding his paper Mr. Beck stressed emphatically that measurement of the resistance of grounds is essential from an economic and protective standpoint. It is only by measuring the resistance that the adequacy of one electrode or the need for more electrodes can be determined. A discussion of Mr. Beck's paper follows.]

Mr. Rudd: About 25 years ago we had a paper like this and it brought out that one ground wire over power lines was a good thing, that two or more were still better. At that time I asked the reader of the paper, Dr. Creighton, whether the real answer was not to put the wire underground. He said yes. We installed on the Pennsylvania about 200 miles of underground power line and then our troubles began. We are still fixing that underground wire. May we just depend on the fact that the cable is in the ground with the sheath on it, or should we try the ground rods and ground the sheath to them?

Mr. Beck: It would be advisable to ground the cables at certain intervals in those localities where the soil resistance is high. In a good many places I believe the underground lines pass through limestone rock formation, of which the soil resistance is high. In those localities, it might be possible that high voltage would be induced in the cable sheath, and they might be relieved from the sheath to the conductors and from there to ground.

Mr. Rudd: Between Lancaster and Harrisburg, in a limestone soil, up near the iron ore mines, we have had blow-out after blow-out.

Mr. Beck: That is the reason those voltages occur. The strata subsoil which acts as the other electrode for the cloud is below the line. In those localities it would probably do considerable good to ground the lead sheath to a few artificial grounds.

Mr. Rudd: We are just installing a 440-volt power line underground. We are putting a very thin lead sheath on it simply as a lightning protection. I am wondering now whether we are doing the right thing or not.

Mr. Beck: I should think that would increase the amount of electrolysis. If you electrify, you will have to take steps to prevent electrolysis.

F. W. Pfleging (U. P.): For five years we have had difficulty in obtaining a good ground in mountainous territory. Three years ago we made some experiments by driving a ground in sand and measuring the resistance. The resistance was 125 ohms. We drilled a hole 6 in. in diameter and 6 ft. deep and placed the rod in with the loose sand and gravel and the resistance was 65 ohms. We drilled a 6-in. hole, 6 ft. deep, used one sack of cement salt, one of clay loam, mixed it, put it in the hole, and the resistance was 6 ohms. We have been using that type of ground in such territory for the last two years. At one location where we had had four automatic switchboards burn out in about six weeks we have not had any trouble from lightning. Two such grounds were installed.

W. J. Eck (Southern): We have about 3,000 miles of transmission line without a ground wire above the line. It has been our experience that the first season after the line was installed we had more lightning trouble than in any other season, which convinced us that the grounds were high. They gradually became better. We used a solid galvanized iron rod, 8 ft. long, and have salted that rod from the beginning, renewing the salt every spring. We started in 1913 to use the salted ground rod and our troubles from lightning are now practically over. We also started out with the lightning arrester on the pole one span from the transformer to keep the apparatus off the transformer pole, but found that when so located they would protect only against storms approaching from the direction in which the arresters were located from the transformer, so we put an arrester or two at every transformer and it has worked out well.

Mr. Beck: The most accurate way of measuring ground resistance is by the use of alternating current for measuring the current and voltage. If direct current is used for measuring, the soil around the electrodes polarizes, and the apparent resistance increases very rapidly so that a measurement made by direct current is inaccurate. It may be out 25 per cent. However, in the case of lightning arrester grounds, that is probably not a very great error. What we are interested in is whether the ground is 10 ohms or 15 ohms or 100 ohms. Portable instruments are on the market for measuring ground resistance.

[The committee was then excused with the thanks of the section].

Report of Committee on Chemicals

I. S. Raymer (P.&L.E.)
Chairman
R. F. Annear (C.R.I.&P.)
R. D. Ashley (I.C.)
G. L. Baggerman (L.&N.)
F. A. Beck (Penna.)
C. R. Happ (B.R.&P.)
I. K. Johnson (D.L.&W.)
C. F. Jones (Sou.)

I. S. Raymer

A. B. Himes (B.&O.)
Vice-Chairman
H. L. Kilian (N.Y.C.)
H. C. Lorenzen (P.M.)
D. S. Rice (L.V.)
B. H. Richards (D.&H.)
E. B. Smith (N.Y.C.)
W. S. Storms (Erie)
A. H. Yocum (Reading)

THE COMMITTEE submitted for submission to letter ballot to supersede subject matter now in the manual, eight revised specifications:

Revision of R. S. A. Spec. 3313, Gravity Battery Coppers, A. R. A. Signal Section Spec. 3328.

Revision of R. S. A. Spec. 3413, Gravity Battery Zincs, A. R. A. Signal Section Spec. 3428.

Revision of R. S. A. Spec. 4314, Electrolyte for Lead Type Storage Battery, A. R. A., Signal Section Spec. 4328.

Revision of R. S. A. Spec. 5015, Crystallized Copper Sulphate, A. R. A. Spec. 5028.

Revision of R. S. A. Spec. 5316, Composite Type Storage Battery for Signaling, A. R. A. Signal Section Spec. 5328.

Revision of R. S. A. Spec. 5817, Pure Lead Type Stationary Storage Battery for Signaling, A. R. A. Signal Section Spec. 5828.

Revision of A. R. A. Spec. 11321, Primary Battery Jar, A. R. A. Signal Section Spec. 11328.

Revision of A. R. A. Signal Section Spec. 11722, Glass Battery Jar for Storage Cells, A. R. A. Signal Section Spec. 11728.

A new specification, A. R. A. Signal Section Spec. 14428, Dry Porcelain Insulation, was also present as given in abstract herewith.

Specification for Dry Process Porcelain Insulation

1. Purpose—(a) The purpose of this specification is to provide dry process porcelain parts for terminal blocks, R. S. A. 1056, and for mounting lightning arresters, switches,

fuses and similar apparatus used in signal work, where apparatus is installed in housings and voltages do not exceed 660.

2. Drawings—(a) Purchaser's drawings accompanying this specification and forming an essential part thereof, are as follows: 1. .....

(b) Contractor shall furnish with his tender, drawings forming an essential part thereof.

3. Tender—(a) The tender shall be for apparatus meeting the requirements of this specification. If the contractor wishes to vary from the specification, a tender may be submitted covering the apparatus he desires to furnish. This tender shall be accompanied by full information showing wherein the requirements of the specification are varied from.

4. Material and workmanship—(a) The material shall be of the best commercial grade so as to provide a homogeneous body or mass, which shall be clean white color, hard, tough, dense and uniform throughout.

(b) Parts shall be true to shape and free from sharp edges, projections, checks, flaws, cracks, chips, holes, laminations, metallic substances, or other irregularities or defects due to improper or imperfect mechanical treatment, faulty drying or firing; inconsistent with the best commercial manufacture.

(c) Surfaces of parts shall be glazed where specified on drawings. The glaze shall be smooth, bright, firmly adherent, thoroughly vitrified and free from bubbles, cracks, checks, crazing or undissolved particles and shall be continuous over the specified portion of the surface.

(d) In the compounding of the glaze, lead oxide or lead salts, injurious to the glaze, shall not be used and the mixture shall have as nearly as possible the same coefficient of expansion as the porcelain.

(e) The finished parts shall conform to dimensions and tolerances shown on drawings.

(f) A minimum tolerance will be allowed of 1.5 per cent plus or minus.

5, Inspection; 6, Tests; 7, Packing; 8, Marking, and 9, Warranty, are standard sections.

Action recommended, acceptance for submission to letter ballot.

Discussion

[Chairman I. S. Raymer (P. & L. E.) introduced the report and asked H. L. Kilian, (N. Y. C.) to present the specification on dry process porcelain insulation.]

A. H. McKeen (U. P.): Committee VI. has prepared designs covering specifications here on glazed porcelain. What portions should be glazed on various types of apparatus, particularly the R. S. A. terminal?

R. B. Elsworth (N. Y. C.): We had occasion recently to go into the matter of glazing and we found if the porcelain was of proper material and density, the glazing did not materially affect the insulating qualities, but assisted in keeping the porcelain clean. If that is correct from an electrical point, it would seem that Committee VI would have no trouble in deciding what part to glaze.

E. T. Ambach (B. & O.): The ceramic engineers have developed porcelains that are dense enough to avoid accumulation of moisture. The glazing is principally done for the purpose of keeping out moisture; it has no dielectric property whatsoever. The moisture that may get into poor porcelain causes the trouble in all porcelain electrical devices.

[The motion that the *specification on dry process porcelain be approved for submission to letter ballot was carried.* Chairman Raymer presented several of the specifications which he explained had been brought up to date without any material change on the contents. These several specifications were adopted without much discussion for inclusion in the manual to supersede previous specifications on the same subjects. These specifications included the ones on gravity battery coppers, gravity battery zincs, electrolyte for lead type storage battery, crystallized copper sulphate, composite type stationary storage battery for signaling, pure lead type stationary storage battery for signaling, primary battery jar and glass battery jar for storage cells. The committee was then dimissed with the thanks of the section.]

Report on Mechanical Interlocking

W. N. Spangler (Penna.)
Chairman
T. S. Adams (N.Y.C.)
L. Brown (A.T.& S.F.)
W. F. Cook (D.& H.)
O. Frantzen (N.Y.N.H.& H.)
W. Hiles (C.C.C.& St.L.)
C. J. Kelloway (A.C.L.)

W. N. Spangler

W. F. Zane (C.B.& Q.)
R. W. Taylor (B.& O.)
Vice-Chairmen
H. F. Lomas (I.C.)
W. B. Morrison (N.Y.C.)
B. F. Oler (Penna.)
E. J. Relph (N.P.)
C. Smith (St.L-S.F.)
M. Sutherland (B.& M.)

IN the interest of simplification of specifications, this committee submitted a revision and consolidation of two earlier specifications relating to mechanical and electro-mechanical interlocking facilities. The new reference number is A. R. A. Sig Sec. Spec. 6628. The specification is exceptionally thorough and covers the following features: (1) Buildings; (2) Power supply; (3) Distribution of power; (4) Interlocking machine; (5) Leadout; (6) Foundations; (7) Pipe lines; (8) Switch fittings; (9) Signals; (10) Circuits; (11) Trunking, conduit and supports; (12) Instrument and battery shelters; (13) Insulation; (14) Painting; and (15) Special items.

The specification outlines the materials and labor

which the railroad is expected to furnish in any construction work of this nature. Following this there are listed certain requirements to be met when inspecting, testing and placing the plant in service. Dielectric requirements include a 3,000-volt a-c. insulation test between all parts of electric circuits and other metallic parts insulated therefrom. It is further specified that a surface leakage distance of not less than ¼ in. shall be provided between any exposed metallic part carrying current and any other metallic portion of the apparatus. A short circuit test of windings is required under a potential twice the normal operating value and of a suitable frequency. The latter test is made across the electrical winding of any coil for a period of one minute and there should be no indication of any excessive current flow as might be caused by a short circuit.

Complete specifications for each of the component parts of a mechanical or electro-mechanical plant are given and these cover the features already listed in the first paragraph. That part of the specification relating to the interlocking machine is as follows:

Machine—(a) Interlocking machine shall be in accordance with the following specifications: (1) Mechanical Interlocking Machine, S. & F. Locking—A. R. A. Sig. Sec. Spec. 7527; (2) Mechanical Interlocking Machine, Style "A" Locking—A. R. A. Sig. Sec. Spec. 11427; (3) Electro-Mechanical Interlocking Machine, S. & F. Miniature Locking—A. R. A. Sig. Sec. Spec. 12526; (4) Electro-Mechanical Interlocking Machine, Unit Electric Levers, S. & F. Locking—A. R. A. Sig. Sec. Spec. 13226; (5) Electro-Mechanical Interlocking Machine, Vertical Locking—A. R. A. Sig. Sec. Spec. 13425.

(b) One mechanical lever shall not operate more than: (1) One mechanical signal; (2) Two pairs of switch points; (3) Two full length detector bars; (4) One switch and lock movement and one full length detector bar; (5) One eight-way mechanical bridge coupler; (6) The combination of rail locks, bridge locks, mechanical bridge couplers when the total load of such combination exceeds the load of one eight-way mechanical coupler.

In respect to the signals to be used in a mechanical or electro-mechanical plant, the specification provides that the railroad will designate or furnish the following circuit plans for the contractor's guidance (where the contractor's standard practice or plans are followed, they must first receive approval of the railroad):

(1) Home signal control; (2) Signal indicating; (3) Switch control circuits; (4) Switch indicating circuits; (5) Approach signal control circuits; (6) Approach signal indicating circuits; (7) Approach locking circuits; (8) Traffic locking circuits; (9) Sectional locking circuits; (10) Route locking circuits; (11) Route locking with sectional release circuits; (12) Time locking circuits; (13) Telephone circuits, etc.

Paragraph 76 stipulates that:

(a) Common return wires shall be without joints between home and dwarf signal limits and shall be sectionalized at locations wherever possible, without overlapping or use of additional instruments; (b) Where common return is used, it shall be available for test at each line break location. *R-76-b; (c) All connections to common return, except line taps, shall be made in terminal boxes; (d) No common return shall be less than No. 12 A. W. G.

*Section 6628. Alternate requisites.

Discussion

[Chairman W. N. Spangler (Penna.), presented this report, which was recommended to be submitted to letter ballot superseding subject matter in the manual. *A motion to this effect was carried*].

Report on Power Interlocking Plants

E. T. Ambach (B.&O.)
Chairman
F. J. Ackerman (K.C.T.)
T. A. Allan (C.N.)
R. B. Amsden (I.C.)
D. W. Fuller (A.T.&S.F.)
T. Holt (Penna.)
J. H. Oppelt (N.Y.C.&St.L.)

E. T. Ambach

W. C. Sibila (N.Y.C.)
I. A. Uhr (St.L-S.F.)
Vice-Chairmen
E. B. Pry (Penna.)
C. D. Rex (Sou.)
T. C. Seifert (C.B.&Q.)
O. R. Unger (M.P.)
G. A. Ziehlke (U.P.)

THE COMMITTEE submitted reports on:
(1) Revision of R. S. A. Spec. 6518.
(2) Typical power circuits.
(3) A. R. A. Sig. Sec. Spec. 14128.
(4) Typical circuits for automatic interlocking; single track crossing single track; A. R. A. Sig. Sec. Spec. 70191 and 70192.
(5) Typical circuits for automatic interlocking; single track crossing double track; A. R. A. Sig. Sec. Spec. 70201 and 70202.

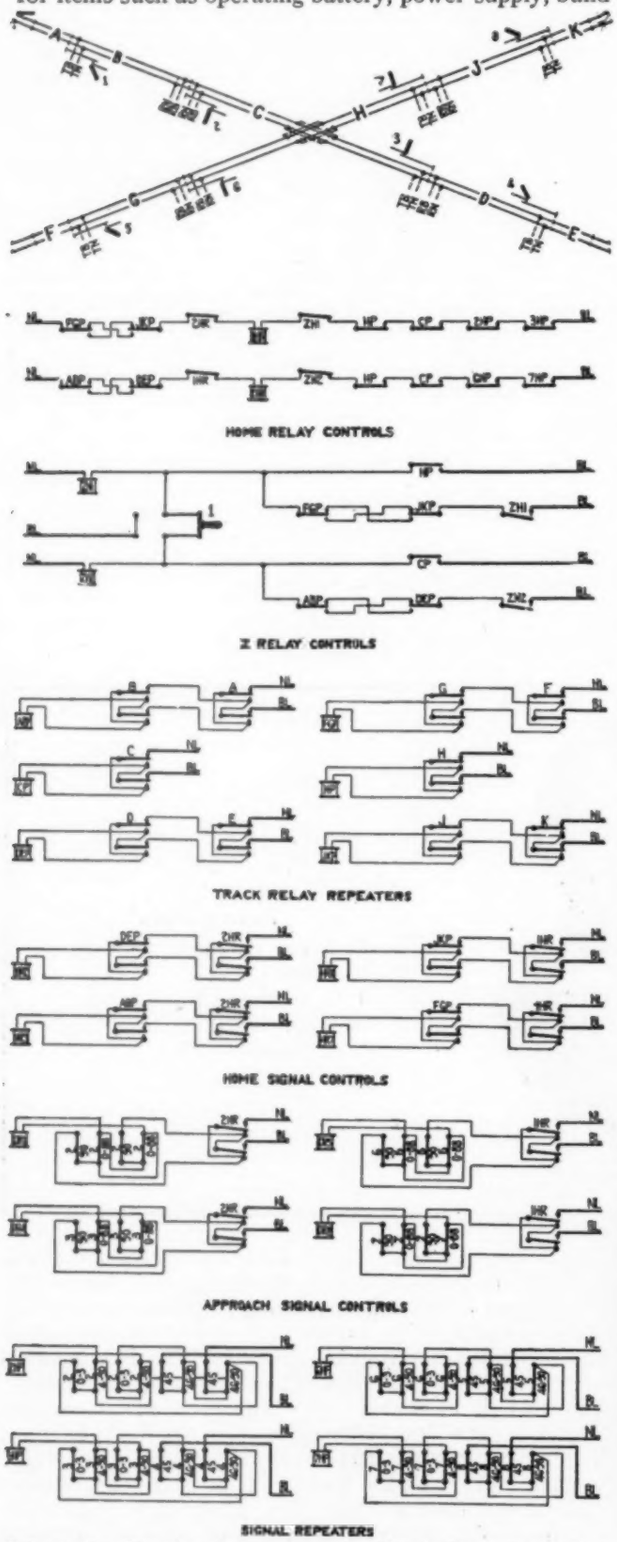
The revision of R. S. A. Spec. 6518 provides for the installation of an electric interlocking system and details the requirements for the individual units of a power interlocking system. As revised, the specification will in future be designated as A. R. A. Sig. Sec. Spec. 6528.

The part of the report relating to power interlocking circuits outlined the number of typical circuits which the committee is studying, namely: (1) Home signal control; (2) Signal indication; (3) Switch control; (4) Switch indication; (5) Approach signal control; (6) Approach signal indication; (7) Approach locking; (8) Traffic locking; (9) Sectional locking; (10) Route locking; (11) Route locking with sectional release; (12) Time locking; and (13) Lever light indicating. Of these, the report submitted four showing sectional locking, route locking, route locking with sectional re-

lease, and time locking. These were all typical circuits and were submitted for the purpose of discussion to bring out any revision which might be found desirable in these typical plans.

A. R. A. Sig. Sec. Spec. 14128 covers the installation of an automatic interlocking, such as employed to protect the crossing of two railroads at grade. Except for items such as operating battery, power supply, buildings, etc., which are not required for an automatic plant, the new Specification 14128, Automatic Interlocking, is similar to the Sig. Sec. Spec. 6528, Installation of Electric Interlocking System.

The diagrams which accompanied the specifications show typical circuits for an installation of an automatic plant at a crossing of two single-track lines or at a crossing of a single-track with a double-track line.



Schematic Circuits for Automatic Signal Protection at a Single-Track Grade Crossing

Discussion

[Chairman E. T. Ambach (B. & O.), presented the report, and his motion that *the specifications covering typical power interlocking circuits be submitted to letter ballot for approval and inclusion in the manual was carried.* He next presented the specification for automatic interlocking, stating that this specification is now combined with the power interlocking and the mechanical interlocking specifications.]

J. S. Gensheimer (Penna.): I have no comments to make on the specification, but as chairman of Committe VI I am interested in it because our committee is supposed to prepare the definition.

Chairman Ambach: By courtesy of RAILWAY SIGNALING I find that in 1927 there were 27 automatic interlocking plants installed in the United States, and 4 in Canada. At the end of the year there were 9 under construction. A total of 41 is contemplated for 1928. [The motion *that the specification on automatic interlocking be accepted for submission to letter ballot was carried.* Chairman Ambach next presented the specification for typical circuits for automatic interlocking saying that the committee would like to include the stick circuit in these drawings before they are submitted for printing in the proceedings.]

R. B. Elsworth (N. Y. C.): I want to ask the committe if they intend to put a stick circuit in in all cases or only in cases where they cannot get a reasonably short dead section. It would seem that with a right-angle crossing where the frogs permit the insulated joints to be fairly close to the diamond, the stick circuit would not be desired.

Chairman Ambach: Of course the drawing indicated here shows a rather acute angle. If you had a right angle it probably would not be necesary to have the stick circuit. Some signal engineers seem to be under the impression that a stick circuit is always necessary.

L. Wyant (C. R. I. & P.): I suggest that a plan be prepared not showing operative distant signals as the majority of plants in the West are so arranged.

Jobs That Make Engineers Reminisce—The Famous Georgetown Loop

Report on D-C. Automatic Signaling

E. N. Fox (B.& M.)
Chairman
H. D. Abernethy (N.Y.C.)
C. M. Acker (D.& H.)
M. A. Baird (Erie)
D. C. Bettison (U.P.)
J. H. Butridge (I.C.)
G. H. Caley (N.Y.O.& W.)
L. E. Carpenter (Penna.)

E. N. Fox

R. E. Green (M.C.)
Vice-Chairman
J. J. Corcoran (N.Y.C.)
A. M. Gilbert (C.C.C.& St. L.)
C. E. Hartvig (C.R.I.& P.)
G. A. Motry (B.& O.)
P. A. Rainey (Penna.)
A. Reilly (D.L.& W.)
A. A. Stueber (C.B.& Q.)

THE COMMITTEE submitted reports on:

(1) R. S. A. Specification 5716, Wood Trunking and Capping has been revised by the committee and was presented as A. R. A. Signal Section Specification 5728, for approval for submission to letter ballot.

(2) A. R. A. Signal Section Specification 10620, Resistor, was revised by the committee and presented as A. R. A. Specification 10628, for approval for submission to letter ballot.

(3) A revision for the requisites for d-c. block signal circuits is given in abstract herewith.

Under this subject the committee presented revised requisites for discussion. However, they are not complete and the committee expects to confer with Committee X in regard to signal aspects and indications and present a complete revision of the requisites at the 1928 stated meeting.

Under Revision of A. R. A. Signal Division Specification 10520—Tractive Armature Direct Current Neutral Relays, the two following tables for relay characteristics were presented at the 1927 stated meeting:

	"A"		"B"	
	4-ohm relay	2-ohm relay	4-ohm relay	2-ohm relay
Minimum drop-away with contact pressure	0.030	0.044	0.037	0.053
Maximum pick-up and working current	0.070	0.105	0.078	0.114

Question was raised as to why one of these tables only was not used or a table which would show the drop-away values of "A" and the pick-up and working current values of "B." This table has been designated as Table "C" and follows:

	"C"	
	4-ohm relay	2-ohm relay
Minimum drop-away with contact pressure	0.030	0.044
Maximum pick-up and working current	0.078	0.114

After considerable discussion the committee was instructed to issue a questionnaire. The preparation of this questionnaire in a clear, concise, impartial manner required considerable thought and study, and the committee was unable to complete it in form for circularization until early in December. Consequently, it was impossible to submit the revised specification for publication in this advance notice.

D-C. Automatic Signaling Circuits

1. *Track circuits*—(a) Track circuits shall be so designed and connected that the track delay will be de-energized when:

1. A rail is broken, a rail or frog removed.

2. An engine or a car is on any part of the circuit including the fouling section of turnouts or crossovers.

3. A switch or derail is not in proper position where shunting circuits are used.

(b) Track circuits shall extend:

1. To clearance point or derail on turnouts.

2. On crossovers between main and side track so that an engine or car of the shortest wheel base cannot stand on the crossover when both switches of the crossover are closed, without at least one pair of wheels on the track circuit.

3. To approximate center of crossovers between two main tracks.

(c) Track circuits shall be designed to meet requirements of:

1. A. R. A. Signal Section tables of minimum limiting resistance allowable in series with track battery.

2. A. R. A. Signal Section requisites for minimizing effect of foreign current on direct current track circuits, where foreign current conditions so require.

(d) Separate track battery shall be provided for each track circuit.

(e) Where relayed cut sections are used the track relay at cut section shall, when de-energized, open one side of track battery and shunt the adjacent track circuit.

(f) Each track circuit shall be insulated from adjacent track circuits and from each rail of non-track circuited tracks.

(g) The track relay of track circuits on tracks signaled in one direction only shall be preferably located at the end of the circuit nearest the signal governing train movements over such section.

(h) The length of dead section shall be as short as practicable and not to exceed the minimum allowable wheel base of an engine or car.

(i) The distance between dead sections shall be such that a car of maximum wheel base cannot stand entirely on dead sections.

(j) Where tracks are signaled in one direction only the insulated joints shall be preferably located opposite each other and 5 ft. in advance of the signal. When necessary to stagger the joints, they shall be located not less than 5 ft. nor more than 25 ft. in advance of the signal.

(k) Where tracks are signaled in both directions, the insulated joints shall be located as follows:

1. Where opposing signals are opposite, the joints shall be not more than 5 ft. from the signals.

2. Where opposing signals are at same location, but staggered, the joints shall be opposite to or between the signal locations, but the distance between joints shall not exceed the minimum allowable wheel base of an engine or car.

3. Where opposing signals are not at the same locations, joints shall be located in accordance with section (i).

2. *Signal operating circuits.*—(a) The positive and negative

sides of the signal operating circuit shall be broken through the signal control relay or relays.

(b) The circuit shall be so designed that so far as practicable, when the indication of a signal is changing there shall be but one indication displayed.

(c) The circuit shall be so arranged that:

1. The failure of any part of the circuit controlling the indication intended to be displayed shall cause the signal to display a more restrictive indication.

2. The failure of a light or lights in light signaling must not result in a more favorable indication than intended.

3. Signal control relay circuits.—(a) The circuits shall be so designed that so far as practicable the failure of any part of a circuit affecting the control of a signal shall cause the signal to display its most restrictive indication.

(b) Circuits shall not be controlled through the contacts of switch; station or tower indicators, annunciators, or interlocking relays.

(c) The battery or power supply shall be located at the end of circuit farthest from the relay or function operated.

(d) The positive and negative sides of the signal control relay circuits shall be broken through the track relay or relays and/or switch circuit controllers on switches and derails.

(e) Track repeater circuits or other circuits affecting the signal control relay circuit shall be designed the same as the signal control relay circuits.

(f) The circuit controlling the proceed indication of the home signal for three-position signaling and of the approach signal for two-position signaling shall be controlled through the contacts of the home relay of the next signal.

Action recommended, discussion.

Discussion

[Chairman E. N. Fox (B. & M.) presented the report, and referred to the results of the questionnaire recently sent out in connection with the revision of the A. R. A. Sig. Div. Spec. 10520. The committee has received information recently that some of the leading manufacturers can now furnish a relay having a 37 m.a. drop-away and still maintain the low working current and the low pick-up. The discussion originally arose due to the fact that the manufacturers stated that to secure the desired working current and low pick-up, it would be necessary to go to the 30 m.a. drop-away. Chairman Fox then read the questionnaire.]

Chairman Fox: The results of the letter ballot as received to date are as follows (based on mileage): in favor of Relay A, 202 votes; Relay B, 186; Relay C, 22; (based on signals) Relay A, 228 votes; Relay B, 228; Relay C, 38. In other words, a total of mileage and signal votes, Relay A, 430; Relay B, 414; Relay C, 60. Summing it up as to the number of railroads, there were 20 railroads favored Relay A, 23 favored Relay B, and 2 favored Relay C.

Many railroads use the value lower than 25 m.a., 25 use the 25-m.a., value; 9 use a value ranging from 24 to 20; 5 use a value ranging from 28 to 35, and 2 about 35. In other words, out of 41 railroads, all but 9 of them use values of 25 m.a. or higher.

[Mr. Fox then read several of the best letters from different roads covering both sides of the question.]

Mr. Gensheimer: It seems to me these letters which Mr. Fox has read cover the situation pretty well on both sides. It is likely that we may get a relay with a low working current and a high drop-away.

L. F. Howard (U. S. & S.): Safety is always relative and is tied up with economics. If at one time we have established this drop-away value of 37 m.a. there has not yet been produced good and sufficient evidence to cause a recession from that value. It seems to me there are many factors that cannot always be tabulated statistically and necessarily get the right answer. It seems to me it would be like taking a jump in the dark to recede from the 37 value.

O. S. Field (G. R. S. Co.): I hardly think there has been sufficient evidence to substantiate the value of the relays. In view of the discussion that has been raised, I would suggest that the committee might better adopt the 37 m.a. relays and the 70 m.a. working current.

Chairman Fox: With infinite ballast resistance, on a train at the relay end of the circuit, the relay A has a 54 per cent better train shunt resistance than the present A. R. A. relay and Relay B has a 62 per cent better train shunt resistance. With the train at the battery end of the circuit, Relay A shows an increase in safety of 415 per cent over the present relay, and Relay B shows an increase in safety of 360 per cent. Of course, it must be borne in mind that these figures are based on the assumption that there will be no change in the drop-away values throughout the use of the life of the relay. With either Relay A or B there is a very appreciable saving in current over the present relay. Relay A requires 41.7 per cent less current than the present A. R. A. relay, while Relay B requires 35 per cent less than the present relay. If, as seems to be the consensus of opinion of this meeting, we go along on the 37-70 basis, the figures that I have read from Relay B on safety and current economy will be the ones which will apply.

[Chairman Fox presented the specification on wood trunking and capping, which was *accepted for submission to letter ballot to supersede subject matter in the Manual.* Chairman Fox then presented the specifications for resistor, which were *accepted for submission to letter ballot to supersede subject matter in the Manual.* Chairman Fox then read specifications for direct current automatic block signaling circuits.]

G. K. Thomas (A. T. & S. F.): In Item 1-B-1, the rear end of a car projects beyond the center of the rear axle. Eight feet inside the actual clearance point would take care of that.

Chairman Fox: In Item 1 (e), the committee received a suggestion that both sides of the track should be open, and they will give that consideration.

W. F. Zane (C. B. & Q.): In Item 2 (b), I should like to ask the committee whether they have taken into account the effect of a light engine on the stick circuit in A. P. B. signaling as well as the flashing of the additional light, especially with fast motor cars running at high speed.

Chairman Fox: We will be glad to consider it.

S. E. Noble (C. & N. W.): Under 3 (b), interlocking relays have been made for some time which follow the A. R. A. specification as to contact opening, and it seems to me that any relay properly protected which meets the A. R. A. specification as to contact opening should be used for control circuits, if necessary.

Chairman Fox: That is a point which has been up before the section a great many times and has been argued in the committee. Whenever it has been up before the section, it has always, to my knowledge, been turned down.

Mr. Noble: In 3 (d), as I interpret it, it seems to me that a circuit of that type would cost more than the apparent safety that you gain.

Chairman Fox: The committee will also be glad to give consideration to that.

[Mr. Fox read a report on the effect of track cir-

cuit shunting of roller bearings applied to axles and trucks of rolling stock.]

Report on Effect on Track Circuit Shunting of Roller Bearings Applied to Axles of Trucks on Rolling Stock

The two methods of application of roller bearings to railway rolling stock are as follows:

(1) The wheel is rigidly attached to the axle and the roller bearing installed on the hub of the axle and outside of the wheel or on the axle and on the inside of the wheel, the latter method known as the inboard truck type. (2) The roller bearing is installed between the wheel and axle which permits each wheel to rotate on the axle independent of the other which tends to eliminate wheel slippage on curves.

The committee has not made tests to determine what effect either of the above methods of application of roller bearings has on shunting of track circuits, but the committee's tentative conclusions are:

(a) That the proper shunting of the track circuits by rolling stock is dependent on electrical contact between rails and wheels and between wheels and axle, or practically zero resistance.

(b) That where the wheel is rigidly attached to the axle and roller bearings installed on the hub of the axle or on the axle inside the wheel as indicated in paragraph (1), the shunting effect is practically the same as with the type of bearing now in common use.

(c) That where the wheel is of the floating type with the roller bearing between the wheel and axle, as indicated in paragraph (2), it would seem that the shunting resistance of a track circuit with this type of bearing would be variable, and that there is no assurance that an electrical contact between the axle and wheel of as low resistance as where the wheel is rigidly attached to the axle will obtain and be permanent.

The proper operation of interlockings, automatic block signaling, automatic train control and automatic highway crossing protection is dependent on the shunting of track circuits and the committee recommends the following requisites. The application of wheels to an axle used in trucks on railroad rolling stock shall provide a permanent electrical connection without resistance between the wheels and axle.

W. M. Vandersluis (I. C.): Since this report came to my attention, I find that there is a third classification of roller bearings not mentioned. It would come under No. 2, where the two wheels of any individual axle are pressed smooth and roller bearings are placed on either side between the spool and the shaft, which would not give you any trouble. I would suggest that the last clause be changed slightly and the report be modified to include this third classification, to make the conclusions read, "The application of wheels to an axle used in trucks on railroad rolling stock shall provide a permanent electrical connection without resistance between the wheels on the same axle."

Chairman Fox: The committee is agreeable to that.

Report of Committee on Instructions

J. S. GENSHEIMER (Penna.)
Chairman

H. E. ARNOLD (L.V.)
W. A. BARTLEY (I.R.T.)
H. L. BLACK (C.N.)
B. F. DICKINSON (Penna.)
C. E. EARHART (I.C.)
O. FALKENSTEIN (N.Y.C.)
H. J. FOALE (Wab.)
C. J. GOODWIN (N.Y.C.)
C. M. DUFFY (C.R.I.& P.)

J. S. Gensheimer

A. VALEE (D.& H.)
Vice-Chairmen

A. J. KELLY (C.C.C.& St.L.)
F. A. SELKE (C.I.& L.)
A. L. SHEPARD (N.Y.C.& St.L.)
W. H. STILWELL (L.& N.)
B. V. STRICKLAND (R.Co.)
E. S. TAYLOR (C.P.)
G. K. THOMAS (A.T.& S.F.)
L. F. VIEILLARD (L.I.)
G. A. WASHBURN (C.& O.)

THE COMMITTEE submitted reports on the following subjects: (1) Revision of A. R. A. Sig. Sec., Spec. 11521, Portable A-C. Voltmeters; (2) Revision of Instructions for Installation and Operation of Switchboards; (3) Book on signaling including: Chapter II—Symbols, Aspects and Indications; Chapter VIII—Transformers; and (4) Definitions for technical terms used in signaling. The revised specifications on switchboards was presented with the recommendation that it be accepted for submission to letter ballot.

Proposed Chapters for Book

Chapter II—Symbols, Aspects and Indications of the book "American Railway Signaling Principles and Practices" was submitted for discussion and suggestions prior to publication in pamphlet form. This chapter as submitted with the report of Committee V includes a description of cab signals, both audible and visual.

Chapter VIII—Transformers—is a thorough treatise, but not too technical, of the theory and operation of alternating current transformers such as extensively employed for power distribution, signal track circuits and automatic train control. How to compute the losses in a transformer, how to determine efficiency, regulation, rating, etc., of transformers are ably explained. Vector diagrams are made clear and their application to transformer problems demonstrated. This chapter was presented for discussion.

The definitions of "Technical Terms Used in Signaling" as included in the report comprise the terms beginning with "Handle, Lever Latch" and ending with "Pulsation, Electric." These were presented for

approval for letter ballot. The definitions for terms beginning with A to G inclusive have already been submitted in previous reports of Committee V.

Specification for Portable Alternating Current Voltmeters

1. Purpose—(a) The purpose of this specification is to provide for portable alternating current voltmeters for railway signal and train control testing.

2. Tender—(a) The tender shall be for apparatus meeting the requirements of this specification. If the contractor wishes to vary from the specifications, a tender may be submitted covering the apparatus he desires to furnish. This tender shall be accompanied by full information showing wherein the requirements of the specification are varied from.

3. Design—(a) Instruments shall be of a design approved by the purchaser.

4. General—(a) Instruments shall be made in five combinations: 1—Combinations *1-a* and *2-a* for use when a relatively high degree of accuracy is desired. 2—Combinations *1-b*, *2-b* and *3-a* for use when a less accurate instrument is desired.

5. Ranges and scales—(a) Ranges and scales for the different combinations shall be as follows:

—Ranges—		—Scale—				
Combination	Volts	Minimum length of upper arc—inc.	Divisions	No. of blocks	Div. per block	Range of voltage reading
1. (a)	0-0.5 0-2 0-5 0-20	4½	100	10	10	0.1 to 20
(b)	0-0.5 0-2 0-5 0-20	2½	50	5	10	0.1 to 20
2. (a)	0-60 0-120 0-240	4½	120	12	10	12 to 240
(b)	0-60 0-120 0-240	2½	60	6	10	12 to 240
3. (a)	0-1 0-5 0-25 0-125	2½	50	5	10	0.2 to 125

(b) Instruments shall have ranges self-contained, except combination *2-b* may be furnished with an external multiplier for the 240-voltage range.

6. Binding posts—(a) Connections to the instrument shall be made on binding posts. (b) Binding posts shall be locked in position so they will not turn. They shall be provided with non-removable nuts, insulated. (c) The common binding posts shall be plainly marked and the other binding posts marked to correspond with the respective scales.

7. Zero corrector—(a) External zero corrector shall be provided on each instrument.

8. Pointer—(a) Pointer shall have knife edge tip.

9. Mirror—(a) Scale for instruments having minimum scale length of 4½ in. shall be provided with mirror slot directly under the knife edge tip of the pointer.

10. Movable system—(a) The movable system shall turn on hardened, accurately ground and highly polished steel pivots, bearing on highly polished first quality sapphires or equivalent jewels. The movable system shall respond quickly to changes in voltage. Its motion shall be practically aperiodic.

11. Heating—(a) Instrument shall be capable of being left in the circuit indefinitely at full load, or of carrying a momentary overload of 50 per cent without overheating or damaging. (b) The error due to heating alone shall not exceed ¾ of 1 per cent of full scale value when the instrument is left in the circuit for 30 min.

12. Case—(a) Instrument cases shall be moisture and dustproof and shall have a neat and durable finish.

13. Sealing—(a) Instruments shall be sealed to prevent any changes or adjustments without breaking the seal except by means of the zero corrector.

14. Sensitivity—(a) Instruments shall have a sensitivity as follows: Combination *1-a*, not less than 20 ohms per volt. Combination *1-b*, not less than 16 ohms per volt. Combination *2-a*, not less than 12 ohms per volt. Combination *2-b*, not less than 12 ohms per volt. Combination *3-a*, not less than 20 ohms per volt.

Action recommended, acceptance for submission to letter ballot.

Discussion

[Chairman J. S. Gensheimer (Penna.), presented the Specification on 9-C. Voltmeter, and read a memorandum from the Roller Smith Company, abstracted as follows]:

"In consideration of these specifications, the Roller Smith Company believes that the committee should carefully consider what strict compliance with the specifications actually mean in connection with the instruments having combinations 1-A, 1-B and 3-A, wherein the full scale range of 5 volts or less are involved.

"We believe this consideration should be given as in our opinion no type of instrument available is an entirely satisfactory solution of the problem. In order to obtain the sensitivity called for, that is, a minimum of 20 ohms per volt, design has followed either the wound field moving coil type or the thermo-couple type. Both of these instruments possess objections. * * *

"Before the final issuance of these specifications the Roller Smith Company therefore believes that the committee should express itself on the various points enumerated above, and if a preference exists for either type of instrument, it should be made clear."

Chairman Gensheimer: We cannot state in the specification that we should always have the moving coil type, because thus far we have never been able to secure combination 1-A and 1-B, which has a range of ½ volt in anything but the thermo-couple type. The committee would prefer the wound coil type where it can be secured. That is the type that has generally been furnished with the 3-A combination. The electromagnetic type cannot be made with the sensitivity called for in this specification. The revised specification is submitted for acceptance for submission to letter ballot superseding subject matter in the manual.

[*The motion was carried.* Chairman Gensheimer read the instructions on installation and operation of switchboards and his motion that *these instructions be accepted for submission to letter ballot superseding subject matter in the manual was carried.*]

A. H. Rudd (Penna.): I think there is one error in the cab signal aspects that ought to be cleared up right now, that is a confusion in the term cab signal as used in an intermittent device or in a continuous device. There ought to be some distinction made.

W. J. Eck (Sou.): The signal should be a device which indicates correctly to the engineman constantly the condition of the block, the indicator being the device which indicates the condition of the apparatus at a particular time.

P. J. Simmen (Simmen Automatic Railway Signal Co.): While we are beginning to talk about cab signals, I should like to point out to Mr. Rudd that there is a distinction between continuous cab signals and intermittent signals, but why hang the definition so high when we start in? A fixed signal is not a continuous signal, and yet you call it a signal. Why is an intermittent signal that is a continuous indication not a signal?

[Mr. Gensheimer read the chapter on transformers, *which was accepted for submission to letter ballot.* He also read the technical terms used in signaling and his *motion that these definitions as revised be accepted for submission to letter ballot superseding subject matter in the manual was carried.*]

Signal Section Elects New Officers

Committee of tellers reported at close of session yesterday—
Carl F. Stoltz of Big Four chosen

JUST BEFORE the adjournment of the afternoon session yesterday, Secretary Balliet presented the report of the election tellers naming the officers of the Signal Section, A. R. A., elected for the coming year as follows:

Chairman, Carl F. Stoltz, signal engineer, Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati, Ohio.

Vice-chairman, H. W. Lewis, signal engineer, Lehigh Valley, Bethlehem, Pa.

Second vice-chairman, P. M. Gault, signal engineer, Missouri Pacific, St. Louis, Mo.

Secretary-treasurer, H. S. Balliet, train control engineer, New York Central, New York (re-elected).

C. F. Stoltz
Chairman

H. W. Lewis
First Vice-Chairman

P. M. Gault
Second Vice-Chairman

H. S. Balliet
Secretary

Carl Franklin Stoltz

The election of Carl Franklin Stoltz as chairman of the Signal Section, A. R. A., brings to this position a man who has worked diligently as a member of different committees, as committee chairman and in different official positions in the association. Mr. Stoltz was chairman of the Committee on D-C. Signaling from 1919 to 1923. He was elected a member of the Committee of Direction in 1923, second vice-chairman of the Signal Section in 1926, and vice-chairman in 1927.

Carl Franklin Stoltz was born on December 18, 1885, at Bradford, Ohio. Following graduation from the high school in his home town, he attended the Miami University at Oxford, Ohio. It was natural that Mr. Stoltz should follow railroading, for his father was a locomotive engineman and at one time road foreman of engines on the Pennsylvania.

On the completion of his university training, Mr. Stoltz entered the service of the Illinois Central as a draftsman and rodman and later served in the same capacity on the Cairo & Tennessee River. For sixteen months he worked as a draftsman in the chief engineer's office of the Cincinnati, Hamilton and Dayton. He entered the service of the Cleveland, Cincinnati, Chicago & St. Louis as a draftsman in the engineering department on May 22, 1906, and in June of the next year was assigned to signal drafting. On June 1, 1912, Mr. Stoltz was appointed assistant signal engineer with headquarters in Cincinnati and on November 20, 1913, he was promoted to signal engineer.

Mr. Stoltz has four children, three boys and one girl. He takes a great interest in sports in which his children are interested, such as swimming, tennis and hunting. He enjoys a good football game and has important business in Columbus several times during the autumn season. Music is Mr. Stoltz' hobby and friends in attendance at the Signal Section luncheons have frequently been pleased to hear his singing.

The Committee of Direction now includes, in addition to the chairman, first vice-chairman and second vice-chairman, F. J. Ackerman, signal engineer, Kansas City Terminal; R. B. Elsworth, assistant signal engineer, New York Central; W. F. Zane, signal engineer, Chicago, Burlington & Quincy; C. H. Tillett, signal engineer, Canadian National; F. W. Bender, signal engineer, Central Railroad of New Jersey; H. G. Morgan, signal engineer, Illinois Central; H. H. Orr, superintendent signals and telegraph, Chicago & Eastern Illinois; A. H. McKeen, signal engineer, Union Pacific System; A. H. Rice, signal engineer and superintendent telegraph, Delaware & Hudson; J. E. Saunders, signal engineer, Delaware, Lackawanna & Western; L. Wyant, signal engineer, Chicago, Rock Island & Pacific; and W. M. Post, assistant chief signal engineer, Pennsylvania.

Signal Section Registration

A TOTAL of 95 members and 17 guests registered at the convention of the Signal Section, A. R. A., at the Stevens hotel yesterday. With the registration Monday this brings the total for the convention to 608 members and 79 guests, or a combined total of 687. The attendance at this meeting was one of the largest in the history of the association.

Members

A

Abernethy, H. D., gen. sig. inspr., N. Y. C., Cleveland, O.
Alexander, A. F., sig. supvr., C. M. & St. P., Minneapolis, Minn.
Ambrose, J. R. W., chf. engr., T. T., Toronto, Can.
Anderson, F. L., sig. maintr., A. T. & S. F., Winfield, Kans.
Anderson, M. F., sig. for., P. M., Saginaw, Mich.

B

Baggerman, G. L., sig. supvr., L. & N., Paris, Ky.
Barron, H., asst. Eng., St. L.-S. F., Springfield, Mo.
Barthel, H. R., sales eng., American Steel & Wire Co., Chicago.
Beck, H. M., operating engr., Electric Storage Battery Co. Chicago.
Bender, F. W., sig. engr., C. N. J., Elizabeth, N. J.
Beoddy, J. A., gen. sig. inspr., N. & W., Roanoke, Va.
Bishop, C. T., sig. supvr., C. B. & Q., Aurora, Ill.
Boland, W. E., sig. engr., S. P., San Francisco, Calif.
Boles, O. K., supvr. tel. & sigs., Penna., Richmond, Ind.
Burrell, C. F., engr., maint. of way, K. & I. T., Louisville, Ky.

C

Caldwell, L. R., supvr. sig. shops, B. & O., Zanesville, O.
Carroll, P. H., sig. supvr., B. & O., Defiance, O.
Chevalier, H. W., chf. draftsman, C. M. & St. P., Milwaukee, Wis.

D

Dryden, H. M., sig. supvr., B. & O., Dayton, O.
Dunham, L. S., chf. engr., Thomas A. Edison, Inc., Bloomfield, N. J.

E

Edmunds, F. W., pres., Craft, Inc., New York City.

F

Finch, J. C., sig. inspr., M. P., St. Louis, Mo.
Fish, R. H., gen. supt., Can. Nat., Toronto, Ont., Can.

G

Gage, O. A., tech. rep., Corning Glass Works, Corning, N. Y.
Garrity, P. A., west. sales mgr., Thomas A. Edison, Inc., Chicago.
Gaunt, G. S., sales engr., Waterbury Battery Co., Monroe, N. Y.
Gemmel, J. S., service engr., National Carbon Co. & Prest-O-Lite Co., Inc., Cleveland, O.
Gillespie, S. E., res. mgr., Union Switch & Signal Co., San Francisco, Calif.
Goddard, E. E., supvr. sigs., I. C., Carbondale, Ill.
Gray, M. L., asst. to vice-pres., Union Switch & Signal Co., Swissvale, Pa.
Griffin, H. W., asst. east. mgr., Union Switch & Signal Co., New York City.

H

Harding, H. H., sig. supvr., B. & O., Newark, O.
Harshbarger, F. V., draftsman, sig. dept., A. T. & S. F., Topeka, Kans.
Hemphill, F. J., sig. supvr., C. R. I. & P., Trenton, Mo.
Hix, A. P., sig. engr., Terminal R. R. Assn. of St. Louis, St. Louis, Mo.
Hoffman, J. C., sig. supvr., B. & O., Akron, O.
Hoffman, S. C., supvr. sigs., I. C., Champaign, Ill.
Hunot, A., chf. sig. draftsman, M. P., St. Louis, Mo.

J

Jones, J. D., supt. tel. & sigs., Penna., Philadelphia, Pa.

K

Keenan, W. J., vice-pres., General Electric Supply Corp., Boston, Mass.
Keers, C. B., sig. supvr., A. T. & S. F., Chillicothe, Ill.
Kettleson, E. W., sig. draftsman, M. P., St. Louis, Mo.
Kinkaide, H. S., sig. inspr., N. Y. C., Englewood, Ill.
Klaas, E., supvr. tel. & sigs., C. G. W., Dubuque, Ia.
Knowles, C. H., relay inspr., C. of N. J., Elizabeth, N. J.
Koch, F. C., asst. to vice-pres., Railway Signaling, New York City.
Kunde, F. L., sig. supvr., C. B. & Q., Ottumwa, Ia.

L

Lambert, P. E., sig. supvr., C. & N. W., Chicago.
Lamberton, H. C., draftsman, M. P., St. Louis, Mo.
Larsen, L. B., asst. sig. supvr., N. Y. C., Elkhart, Ind.
Leonard, F. A., constr. acct., C. & N. W., Chicago.
Lepreau, F. J., Hastings-on-Hudson, N. Y.
Lightfoot, L. L., asst. sig. supvr., N. Y. C., Toledo, O.
Lollis, B. F., asst. sig. engr., C. B. & Q., Chicago.
Lundy, E. A., pres., E. A. Lundy Co., Pittsburgh, Pa.

M

Marak, C. T., sig. for., M. P., St. Louis, Mo.
McCaulley, C. G., vice-pres., E. A. Lundy Co., Pittsburgh, Pa.
McChesney, L. W., vice-pres. and gen. mgr., Thomas A. Edison, Inc., Bloomfield, N. J.
McCormick, M., Ohio Brass Co., Mansfield, O.
McGill, J. P., asst. to sig. engr., C. C. C. & St. L., Indianapolis, Ind.
Moffett, F. W., asst. gen. mgr., General Railway Signal Co., Rochester, N. Y.
Mock, H. F., sig. supvr., C. & N. W., Green Bay, Wis.
Morphy, L. G., chf. engr. and gen. supt., Rutland, Rutland, Vt.

N

Nelson, G. A., vice-pres. & gen. sales mgr., Waterbury Battery Co., New York City.
Newman, W. H., sig. supvr., N. Y. C., Buffalo, N. Y.
Noble, S. E., asst. sig. engr., C. & N. W., Chicago.
Norris, C. J., supvr. tel. & sigs., Penna., Akron, O.

P

Peabody, J. A., sig. engr., C. & N. W., Chicago.
Prinn, B. H., asst. sig. engr., B. & O., Baltimore, Md.

R

Ratcliff, T. R. engr. maint. of way, I. U., Indianapolis, Ind.
Renick, H. W., pres., Magnetic Signal Co., Los Angeles, Calif.
Renshaw, P., sales mgr., General Railway Signal Co., New York City.
Roberts, J., railway dept., General Electric Co., Schenectady, N. Y.

S

Schermerhorn, E. F., sales engr., The Rail Joint Co., New York City.
Schroeder, J. M., chf. sig. inspr., N. Y. C. & St. L., Cleveland, O.
Schultz, E. E., asst. engr., C. & N. W., Chicago.
Seifert, T. C., office engr., C. B. & Q., Chicago.
Selke, F. A., sig. supvr., C. I. & L., Lafayette, Ind.
Skinner, Ivan, sig. est., M. P., St. Louis, Mo.
Snowden, Wm., supvr. tel. & sigs., C. G. W., Marshalltown, Ia.
Snyder, W. A., sig. supvr., C. & N. W., Madison, Wis.
Swanson, W. W., sig. inspr., C. B. & Q., Chicago.

T

Thayer, O. H., sig. supvr., C. C. C. & St. L., Mattoon, Ill.
Thomas, G. E., sig. for., M. P., Kansas City, Mo.
Tillett, C. H., sig. engr., Can. Nat., Central Region, Toronto, Ont., Can.
Titus, B. F., asst. engr.-train con., N. Y. C., New York City.
Tocher, C. E., asst. engr., M. P., St. Louis, Mo

U

Unger, O. R., asst. engr., M. P., St. Louis, Mo.

V

Vandersluis, W. M., elec. engr., I. C., Chicago.
VanOsinski, H. M., sig. inspr., N. Y. C. & St. L., Cleveland, O.

W

Wall, P. C., relay rep., C. G. W., Oelwein, Ia.
Whitehorn, A. R., sig. engr., E. A. Lundy Co., Chicago.
Woodson, C. P., supvr. tel. & sigs., Penna., Grand Rapids, Mich.
Wray, E., pub., Railway Purchases and Stores, Chicago.

Y

Yarrell, A. J., sig. inspr., C. I. & L., Lafayette, Ind.

Z

Zahnen, J. P., sig. supvr., C. R. I. & P., Chicago.

Guests

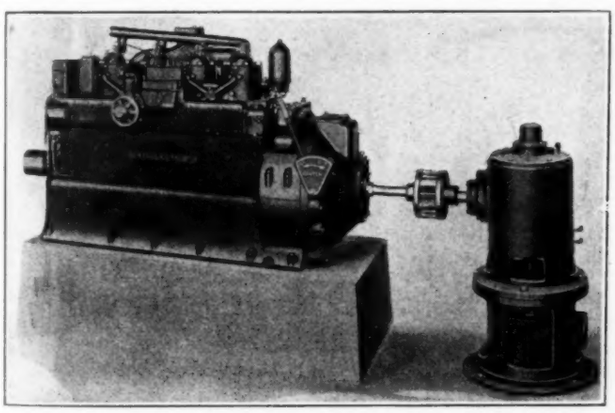
Balliet, R. H. C., A. R. A., New York City.
Brennan, B. J., signalman, D. & L. W., Bath, N. Y.
Brinard, M. R., Brinard Sales & Construction Co.
Brown, R. S., vice-pres., G. M. Basford Co., N. Y.
Burch, H. F., asst. gen. mgr., D. & H., Albany, N. Y.
Burgess, R. H., secy. to gen. supt., Can. Nat., Toronto, Ont., Can.
Carmical, R. W., sales agt., General American Tank Car Corp., Chicago.
Collins, R. W., South Bend, Ind.

Herron, T. J., rep., Philip Carey Co., Cincinnati, O.
Loeffler, B. T.
McKeown, H. A., chf. comm., Board of Railway Commissioners of Canada, Ottawa, Ont., Can.
McPherson, C. J., sig. fore., C. & N. W., Lake Bluff, Ill.
Manley, O. C., dist. sig. fore., C. & N. W., S. Pekin, Ill.
Party, V. A., cons. elec. engr., American Steel Soc., Chicago.
Selquist, R., elec. engr., Copperweld Steel Co., Glassport, Pa.
Sewell, R. T., sig. supvr., Southern, Asheville, N. C.
Van Wagner, P., sales dept., Copperweld Steel Co., Pittsburgh, Pa.

Direct Diesel Engine Drive For Deep Well Turbine Pumps

FAIRBANKS, MORSE & CO., Chicago, have added turbine pumps of the deep well type to their line of pumps by the acquisition of complete sales rights of the turbine pumps manufactured by the G. W. Price Pump & Engine Co., San Francisco, Cal., and have developed a geared speed increaser which permits driving this type of pump by a direct-connected Diesel engine, instead of by a direct-connected vertical motor drive, as desired, thus rendering it possible to change from the one form of drive to the other at any time.

The gear unit for increasing the speed consists of a cast iron housing enclosing two bevel gear shafts, each of which carries a bevel gear to provide the proper gear ratios for the service required. The bevel gears run in oil and the shafts are mounted on ball bearings. The pumps range in capacities from 50 gal. per min. to 1,500 gal. per min., and for wells from 6 in. to 16 in. in diameter. The illustration shows a 60-hp. Fairbanks Morse Diesel engine, operating at 800 r.p.m., direct connected to a speed increaser unit which is so designed that the gear

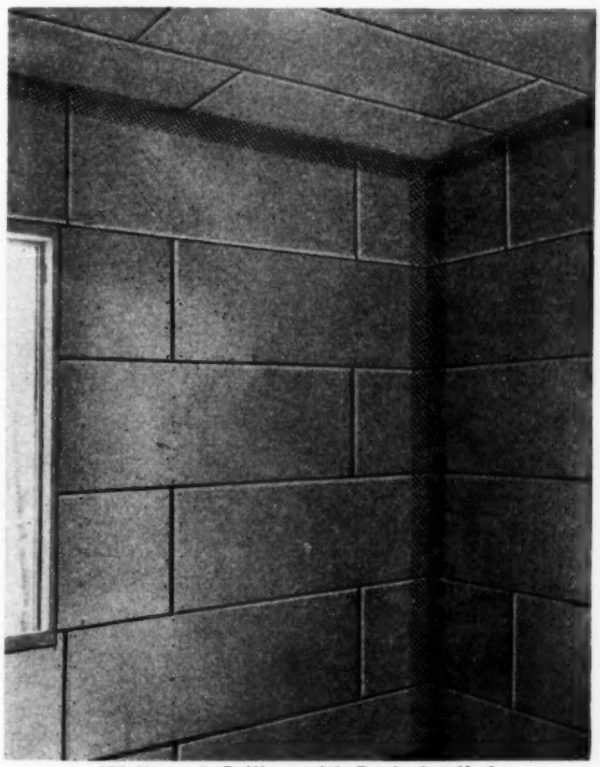


Diesel Engine Direct Connected to Vertical Drive Turbine Pump

ratios may be changed to drive the pump at speeds of 900, 1,000, 1,200, 1,500, or 1,800 r.p.m., depending on the design of pump used and the requisite speed for the service.

A Lath Which Also Provides Insulation

THE CELOTEX COMPANY, Chicago, has developed and placed on the market a lath which combines the functions of a base for plaster and insulation for the purpose of protecting the rooms in which it is used from the heat in summer and from the cold in winter, thus adding to the comfort of the occupants and reducing the cost of heating in the winter season. This lath is 48 in. long by 18 in. wide and weighs 3½ lbs. The edges are beveled on all sides, with shiplap joints on the long sides, thus providing a tight wall of insulating material



Walls and Ceiling with Lath Applied

over the area to which it is applied and precluding the appearance of lath marks through the plaster. The beveled edge of the lath provides a reinforcement for the plaster at the joints to prevent cracking.

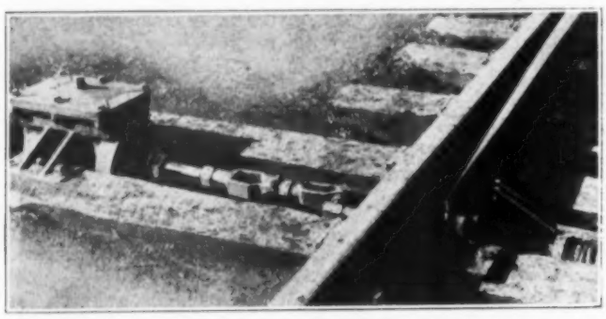
The lath is made of Celotex, a light cellular board manufactured from the fiber of sugar cane, and is said to present a fibrous surface to which the plaster makes a firm bond. The lath is applied with special blued lathing nails by regular lathers. It is said it can be cut easily for special work by scoring with the point of the lathing hatchet, and that it can be bent easily into curves, arches and sweeps. It is also said that the cost is no more than the former large sheets of Celotex furnished for this purpose, while it is easier to apply, especially in restricted places.

The Bethlehem Hydraulic Check for Spring Switches

THE Bethlehem Steel Company has developed and placed on the market a hydraulic check to be attached to the spring rods of spring switches for controlling the closure of the point when the switch is trailed through by a train. The check is designed so that the speed of operation may be regulated for the requirements of any specific installation, changes in the viscosity of the oil in the hydraulic cylinder or for any other reason. The check may be adopted to either right or left hand switches without disassembling.

The check consists of a cast iron cylinder into which a piston connected to the spring rod of the switch, is fitted. A valve at each end of the cylinder opens into a valve chest above the cylinder, one of the valves being covered by a plate which is slightly spring-loaded. The valve chest is approximately the length and breadth of the cylinder and is just deep enough to accommodate the valve plate and springs. A tightly fitting cover, bolted in place, forms the top of the valve chest. The cylinder is filled with oil and the valve chest is filled to about one-half its capacity, a pale semaphore oil being used for this purpose.

When the closed point is trailed through, the piston is forced to the end of the cylinder, displacing



Bethlehem Hydraulic Check for Spring Switches

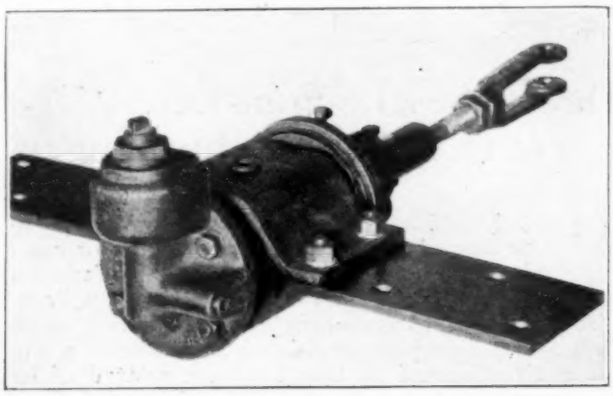
the oil ahead of it and causing it to pass through the spring-loaded valve and thence through the valve chest to the other end of the cylinder. The spring loading on the valve is about eight pounds and hence offers little resistance to the passage of the oil. When the switch point has been forced into the open position the spring on the switch rod tends to restore the switch point to its normal position, drawing the piston with it. The valve through which the oil must pass is so arranged that this can be done only slowly at first but permits faster travel after a short interval, the speed increasing until the switch is closed. By this arrangement the switch point is prevented from springing back sharply against the wheels of successive trucks but is closed firmly after the passage of the last wheel.

Oil Buffer for Spring Switches

AN OIL buffer to reduce the pounding of a spring switch when it is being trailed by a train has been developed by the Union Switch & Signal Company. The buffer consists of an oil cylinder held by a supporting yoke between two extended ties and containing a piston operated by the motion of the switch points. The piston contains a spring valve in its face. Bolted to the back of the cylinder is a sleeve valve and oil reservoir essembly. A stuffing box is bolted to the end of the cylinder nearest the track. A connecting rod is bolted to the switch points and connected through a turnbuckle to the piston of the buffer, thus providing adjustment between these members.

At the start of the operation of the buffer, oil fills the cylinder on both sides of the piston. As the switch points move and the piston begins to travel, oil is transferred from the front of the piston to the rear face through a feed groove in the wall of the cylinder and through the spring valve in the piston face. This permits its first motion to be unrestricted to a point near the end of the cylinder. At this point, the piston has blocked off the feed groove, but oil still may pass through the ports of the spring valve in the piston.

It is desirable that the retarding action take place



Union Oil Buffer for Application to Spring Switch

when the switch points tend to move from the position to which they have been forced by the wheels of the train. At the same time, after the piston has moved a predetermined distance, the spring at the switch should be able to return the points as quickly as possible. This is done in the following manner: When the piston reaches the end of the first motion, it has blocked off the feed groove. If the piston is about to return to its original position, the spring valve will not open, and the only flow of oil that can take place occurs from the oil reservoir, through the timing ports in the sleeve valve and thence, through a passage, to the cylinder. The timing ports in the sleeve valve, by regulating the flow of oil through them, regulate the speed of the motion of the piston. This arrangement permits the buffing action to take place only at the start of the return stroke.

After the piston has traversed a short distance of the return stroke, it again opens the feed groove. Oil is then transferred, through the feed groove, from one piston face to the other and the piston meets with virtually no resistance during the latter part of the return stroke.

A. R. E. A. Registration

(Continued from Page 94)

Tarwater, Lawson, vice-pres., Universal Nut Lock Co., Kansas City, Mo.
Teal, D. C., field draftsman, C. & O., Richmond, Va.
Tefft, J. F., asst. div. engr., Saginaw, Mich.
Turley, C. D., supvr. of tr., Chicago.
Turner, William, roadm., A. T. & S. F., Arkansas City, Kans.
Von Eltz, K., New York City.
Waggener, R. G., asst. engr., T. & P.
Waggner, H. O., div. engr., A. T. & S. F., Amarillo, Tex.
Walker, G. M., Jr., asst. engr., G. C. & S. F., Galveston, Tex.
Wall, G. B., Jr., asst. engr., C. & O., Richmond, Va.
Warner, G. S., roadm., Can. Nat., Capreol, Ont., Can.
Weedon, R. E., supt. of rd. sh., Southern, Washington, D. C.
Weiss, Charles, supvr., Penna., Harrington, Del.
Wicker, C. S., sales mgr., Buffalo Slag Co., Buffalo, N. Y.
Wild, H. J., rep. ch. of eng., U. S. Army, Chicago.
Wilder, A. M., roadm., A. B. & C., Atlanta, Ga.
Willett, C N., Capreol, Ont., Can.
Williams, R. A., sales engr., American Car & Foundry Co., St. Louis, Mo.
Wright, B. F., roadm., C. R. I. & P., Herrington, Ky.
Yerron, T., roadm., Can. Nat.
Younger, H. K., roadm., Can. Pac., Revelstoke, B. C., Can.
Zimmerman, A. L., div. engr., M. P., San Antonio, Tex.